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Annual Industrial Capabilities Report
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INTERNET DOCUMENT INFORMATION FORM

A . Report Title :Annual Industrial Capabilities Report to Congress
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**C. Report's Point of Contact: (Name, Organization, Address,
Office Symbol, & Ph # 703-602-4297 Office of Defense Under
Secretary of Defense (IA&I) Pentagon Washington D C**

D. Currently Applicable Classification Level: Unclassified

E. Distribution Statement A: Approved for Public Release

F. The foregoing information was compiled and provided by:
DTIC-OCA, Initials: __JC_ ____ Preparation Date: 2001/02/01

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Foreword

As we enter the 21st Century, the United States faces a dynamic security environment marked by dramatic geopolitical, military, economic and technological change. The United States and its coalition partners must successfully navigate this transformation to ensure that the new century is more peaceful and stable than the one we have left behind. To successfully meet our responsibilities in this environment, the Department of Defense (DoD) must rely upon a competitive and robust defense industry that can produce the innovative, high quality and affordable products needed to meet U.S. national security goals.

Within the emerging global security environment, this report discusses DoD's industrial capabilities-related policies, objectives and analyses. It also discusses cooperative actions between U.S. allies and industrial partners to establish an appropriate framework for industrial linkages that can facilitate interoperability among weapons systems, improve coalition warfighting capabilities, and leverage efficiencies and continued competition for defense goods and services.

Jeffrey P. Bialos
Deputy Under Secretary Of Defense
(Industrial Affairs)

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1. Annual Report Requirements

Section 2504 of Title 10, United States Code, requires that the Secretary of Defense submit an annual report to the Committee on Armed Services of the Senate and the Committee on National Security of the House of Representatives, by March 1st of each year. The report is to include descriptions of:

- Department of Defense (DoD) industrial and technological guidance issued to facilitate the attainment of national security objectives, including that guidance providing for the integration of industrial and technological capabilities considerations into its budget allocation, weapons acquisition, and logistics support decision processes.
- Methods and analyses undertaken by the DoD alone or in cooperation with other Federal agencies, to identify and address industrial and technological capabilities concerns.
- Industrial and technological capabilities assessments prepared pursuant to section 2505 of Title 10, United States Code, and other analyses used in developing the DoD's budget submission for the next fiscal year, including a determination as to whether identified instances of foreign dependency adversely impact warfighting superiority.
- DoD programs and actions designed to sustain specific essential technological and industrial capabilities.

This report contains the required information.

2. Overview

This report describes the nation's defense environment, DoD's industrial objectives and initiatives, relevant new internal policy guidance, analyses used to identify industrial capabilities issues, and actions taken to address concerns associated with specific essential industrial and technological capabilities. It also describes related activities to evaluate and improve defense-critical industrial and technological capabilities.

As the 21st Century begins, the U.S. faces a dynamic and uncertain security environment that poses significant security challenges. The U.S. military will be called upon to respond to crises in order to protect national interests, demonstrate U.S. resolve, and reaffirm the nation's role as a global leader. U.S. forces must be able to execute the full spectrum of military operations, from deterring an adversary's aggression or coercion in crisis and conducting concurrent smaller-scale contingency operations, to fighting and winning major theater wars.

U.S. forces must be able to do this either unilaterally, or, preferably, as part of a coalition. Building and maintaining effective coalitions present significant challenges, from policy coordination at the strategic level to interoperability among diverse military forces at the tactical level. Because coalitions will continue to present both important political benefits and not insignificant military challenges, U.S. forces must plan, train, and prepare to respond to the full spectrum of crises with the forces of other nations.

The changes in the security environment have in turn produced a dynamic industrial environment. Defense firms have reduced excess infrastructure and workforce levels to better match reduced demand, streamlined processes, increased productivity, and revamped supplier relationships. They also began a process of significant industry consolidation via mergers and acquisitions that continues today. In the United States, high value merger and acquisition activity among first tier prime (platform, electronics/missiles, and engine) contractors is slowing. However, the pace of aerospace and defense industry consolidation among second and third tier suppliers has increased as these suppliers seek to improve core competencies and increase market penetration.

In general, DoD believes that the industry supporting defense continues to be capable of generating the investment and skills necessary to provide affordable, innovative, and high quality defense products. By and large, DoD has been able to preserve competition and innovation while allowing the defense industry to follow a rational course of consolidation. For the nine restructurings for which it has audited cost data, DoD expects to accrue net savings (after restructuring costs) of \$3.5 billion through 2003.

In recent months, a series of events -- problems on specific programs, reduced earnings estimates, and significant declines in the price of certain U.S. defense stocks -- have led to questions about the overall health, structure, and competitiveness of the U.S. defense industry. Large defense firms clearly are going through a transition period as they seek to adjust to the large number of mergers and acquisitions of recent years. Successfully absorbing acquired firms is a complex process involving restructuring management, possible rationalization of facilities

and personnel, and dealing with the inevitable dislocations involved in significant consolidations. The defense industry faces a series of long-term challenges, which the Department will continue to monitor.

Western Europe has not been immune to the budgetary pressures that have driven U.S. defense industry consolidation. Significant European consolidation activity in 1999 has raised the risks of rival U.S. and European "fortresses" each dominating their respective geographic markets and competing vigorously for international sales in developing country markets (with attendant risks for arms proliferation). A "Fortress Europe - Fortress U.S." industrial environment -- in which a pan-European firm and several large U.S. firms have closed home markets and compete only in the third world -- is not desirable. It could result in the separate evolution of U.S. and European military technologies and undermine competition.

The European view is that these industrial restructurings will not create a "Fortress Europe" but instead are a necessary first step before enhanced transatlantic linkages. As a matter of fact, industrial linkages between the United States and its allies already exist and are increasing. The Department will be vigilant in monitoring and working aggressively to preclude the formation of a "fortress" environment.

To facilitate vigorous competition in defense markets, DoD continues to participate in merger and acquisition reviews with the antitrust agencies to ensure that proposed transactions do not adversely affect competition and innovation for DoD programs. Additionally, DoD is taking steps to: (1) consider the potential effects of important technology and acquisition investments on future competitive suppliers; and (2) take appropriate action in those exceptional cases in which it expects inadequate future competition.

The Department also continues to promote civil-military integration. If DoD is to acquire affordable systems quickly, in the quantities required, it must pursue non-traditional acquisition approaches, including making full use of integrated commercial/military assembly lines for otherwise defense-unique items. Civil-military integration, eliminating the distinction between doing business with the government and other buyers, is critical to meeting future military, economic, and policy objectives.

DoD is seeking to strengthen U.S. industrial linkages with key coalition partners in Europe and elsewhere to facilitate interoperability, improve coalition warfighting capabilities, and leverage efficiencies and continued competition for defense goods and services. DoD is committed to the principle of reciprocal market access. It is reviewing its acquisition practices that result in the exclusion of foreign sources to determine which practices are antiquated and which still are necessary to protect U.S. national security interests. DoD also is being vigilant and guarding against a "Fortress Europe" mentality that could discriminate against U.S. equipment. The Department also will encourage and facilitate specific industrial linkages -- joint ventures, teaming arrangements, and other forms of cooperation that will further the nation's national security objectives.

Finally, to maintain industrial readiness, DoD is employing programs to: (1) develop or improve defense-critical industrial and technological capabilities; and identify, adapt, and leverage predominantly commercial and dual use capabilities and products for defense applications, and (2) conduct industrial capabilities assessments to determine the status of industrial or technological capabilities important to DoD.

3. DoD Policy Guidance

A robust and competitive defense industry, at both the prime contractor and subcontractor levels, is vital to providing DoD with the high quality, affordable, and innovative products necessary to meet its responsibilities in the 21st Century. The Department's challenge is to foster an appropriate enabling framework for industrial development and competition in defense markets in an environment marked by dynamic change.

3.1 Strategic Defense Environment

As the 21st century begins, the United States faces a dynamic and uncertain security environment. There is much that is positive. The monolithic military threat, with masses of tanks and aircraft poised to invade Western Europe, has receded. The U.S. economy continues to thrive. Relationships with key allies are strong. Former adversaries, like Russia and other former members of the Warsaw Pact, now cooperate with the United States across a range of security issues. Nevertheless, the world remains a complex, dynamic, and dangerous place.

Within this evolving environment, the United States faces significant and asymmetric security challenges. In the near-term, the multiplicity of threats include: risks of regional conflict in which the United States has significant interest; possible internal conflicts that threaten U.S. interests (including civil wars, internal aggression and armed uprisings); the spread of weapons of mass destruction; state sponsored and transnational terrorism; and organized crime, illegal drug trade, and other violent threats to U.S. institutions and citizens. Additionally, U.S. forces may be called upon to provide stability, disaster relief and other forms of emergency assistance in response to a wide range of circumstances, including failed states, famines, floods, hurricanes, and other natural or man-made disasters.

The rapid pace of technological change also is significantly affecting the security environment. In World War I, DoD purchased weapons (guns, grenades) and in World War II DoD purchased weapons systems (tanks, aircraft, naval vessels). Today, DoD purchases systems of systems; the interconnections between the individual weapons systems are as important as the individual systems themselves. As a consequence, DoD's approaches to buying and controlling the important technologies that permit these interconnections are evolving.

Similarly, there are ongoing and remarkable changes in the commercial sphere. National borders increasingly are irrelevant to how businesses are organized and staffed. Globalization is occurring at a rapid pace in industries ranging from telecommunications to finance. At the same time, the distinction between civil and military sectors increasingly is blurred. The United States, as well as its friends and potential foes, relies increasingly on commercially and globally available technologies to develop or enhance military capabilities. Moreover, the rise of the internet and other forms of communication have significantly increased productivity, changed ways of doing business, and increased cross-border information flows.

3.2 Defense Strategy

It is imperative that the United States maintain its military superiority in the face of the evolving threats and challenges noted above. The United States must achieve a new level of proficiency in its ability to conduct joint and combined operations in an era when coalition warfare is likely to be the preferred, if not the only, path. Building and maintaining effective coalitions present significant challenges, from policy coordination at the strategic level to interoperability among diverse military forces at the tactical level. Unfortunately, the recent Balkans conflicts have highlighted that the longstanding U.S. quest for interoperability with its allies has not yet succeeded. As the U.S. military adopts new technologies and operational concepts, DoD must design its systems carefully and collaborate with its allies to ensure it meets the new interoperability challenges.

The Department's commitment to preparing now for an uncertain future has four main elements:

- Focusing modernization efforts aimed at replacing aging systems and incorporating cutting-edge technologies into the force.
- Pursuing the Revolution in Military Affairs by developing and adopting innovative operational concepts and new organizational arrangements, new information systems, and other technologies that will allow U.S. forces to be smaller, faster, more agile, more precise, and better protected.
- Exploiting the Revolution in Business Affairs to reengineer the Department's infrastructure and business practices. Measures are aimed at shortening cycle times, particularly for the procurement of mature systems; enhancing program stability; conserving scarce resources; ensuring that acquired capabilities will support mission outcomes; ensuring that critical infrastructures deliver the right services to the right users at the right time; increasing efficiencies; and assuring management focus on core competencies, while freeing resources for investment in high-priority areas.
- Hedging against unlikely but significant future threats by maintaining a broad research and development effort (including an emphasis on adopting and adapting commercial technologies to military needs); using advanced concept technology demonstrations to provide a prototype operational capability for warfighter evaluation; continuing contacts with industries developing new technologies; and cooperating with allies who may develop new approaches to resolving problems.

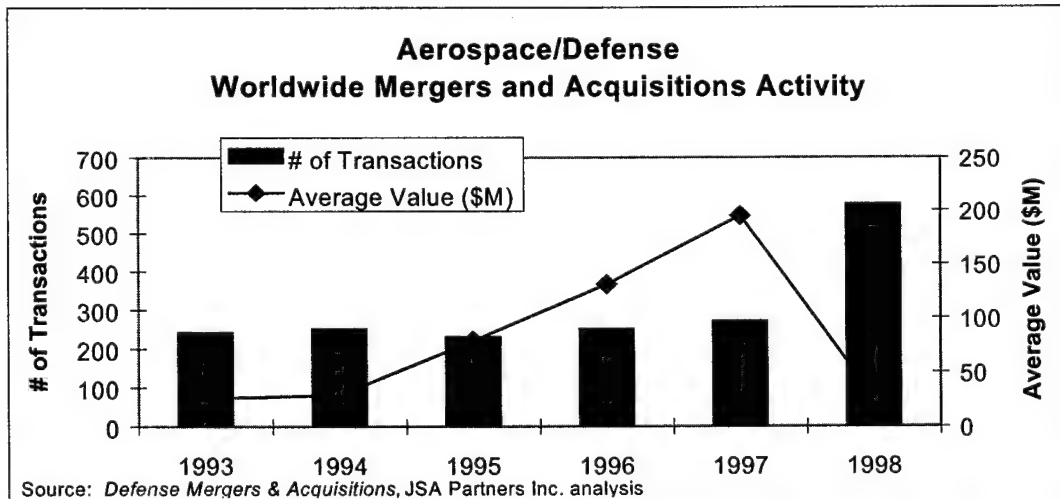
Successfully implementing this defense strategy requires substantial and ready forces and a focused program of investments to improve the equipment those forces will employ. In the years immediately following the end of the Cold War, the Department's reductions in spending came disproportionately from reductions in procurement spending. This prudent, calculated

approach was possible because large quantities of modern equipment had been purchased during the 1980s and force reductions had permitted the retirement of older ships, aircraft, and armored vehicles in the early 1990s. That drawdown is now over, the defense budget has stabilized, and the Department is projecting increases in procurement spending. Nevertheless, DoD, in the post-Cold War era, is forecasting fewer major new systems and longer intervals between systems going forward.

3.3 Defense Industrial Environment

The changes in the security environment have in turn produced a dynamic industrial environment as U.S. firms have moved to meet U.S. security requirements in an era of changing threats and declining budgets. Defense firms have initiated a series of actions to consolidate and restructure their operations. They have reduced excess infrastructure and workforce levels to better match reduced demand, streamlined processes, increased productivity, and revamped supplier relationships. U.S. firms also began a process of significant industry consolidation via mergers and acquisitions that continues today.

Worldwide, aerospace and defense consolidation continues at a rapid pace (see chart below). However, the average value of a transaction decreased from \$195 million in 1997 to \$26 million in 1998 (the last year for which complete information was available). In the United States, high value merger and acquisition activity in the defense sector among first tier prime (platform, electronics/missiles, and engine) contractors is slowing, while activity among second and third tier suppliers is increasing as these suppliers seek to improve both capabilities and market penetration.



U.S. Defense Industry Restructuring

The restructuring of the U.S. defense industry to date has provided significant benefits to DoD. For the nine restructurings for which it has audited cost data, DoD expects to accrue net savings (after restructuring costs) of \$3.5 billion through 2003.¹

Moreover, despite significant restructurings and consolidation, at least several capable firms, and a viable supplier chain to support them, compete in each major defense product area. The following table summarizes U.S. prime contractor presence for selected military products. In short, while there are, and always have been, certain low demand, niche, product areas where industrial capabilities may be limited² there still is competition -- and, hence, the prospect of benefits in the form of innovation and efficiency -- in core defense markets.

U.S. Contractor Presence for Selected U.S. Military Products (1990-1999)		
Military Product	Companies¹ (1990)	Companies¹ (1999)
Ammunition ²	9	9
Expendable Launch Vehicles	6	3
Fixed-wing	8	3
Rotorcraft	4	3
Satellites	8	6
Strategic Missiles	3	2
Submarines	2	2
Surface Ships	8	3
Tactical Missiles	13	4
Tactical Wheeled Vehicles	6	3
Torpedoes	3	2
Tracked Combat Vehicles	3	2
¹ Companies producing products in stated year. Not all companies produce all classes of products within a given product area.		
² The number of munitions companies reflects government-owned assembly and explosive production facilities. DoD reduced the number of such facilities extensively prior to 1990 (there were 32 in 1978 and 17 in 1987) and is considering further reductions.		

¹ Hughes - General Dynamics Missile Operations, FMC - Harsco (now United Defense Limited Partnership), Martin Marietta - General Electric Aerospace, Northrop Grumman - Vought, Martin Marietta - General Dynamics Space Systems, Lockheed - Martin Marietta, GM Hughes Electronics - CAE-Link, Northrop Grumman - Westinghouse - Norden Systems, Lockheed Martin - Loral (Electronics Sector). For these transactions, DoD evaluated potential savings associated with contractor restructuring activities such as workforce and facility reductions/relocations to arrive at its projections.

² For example, microwave power tubes, radiation hardened microelectronics, and flat panel displays as discussed in Section 5.3.

Recent U.S. Industrial Developments

In recent months, a series of events -- problems on specific programs, reduced earnings estimates, and significant declines in the price of certain U.S. defense stocks -- have led to questions about the overall health, structure, and competitiveness of the U.S. defense industry. Large defense firms clearly are going through a transition period as they seek to adjust to the large number of mergers and acquisitions of recent years. Successfully absorbing acquired firms is a complex process involving restructuring management, possible rationalization of facilities and personnel, and dealing with the inevitable dislocations and debt burdens resulting from significant consolidations. Plainly, the defense industry faces a series of long-term challenges:

- Consolidation/rationalization. Consolidation has produced significant efficiencies and cost savings for DoD, as summarized above. It is important, however, that the potential benefits of mergers and acquisitions be fully realized. Having now consolidated, industry needs to continue the process of adjusting to budgetary realities and rationalize its operations where appropriate to reduce overcapacity. For example, as Raytheon has combined missile production in its facility in Tucson, AZ, it has seen real cost reductions.
- Maintenance of skilled workforces. An important question is the extent to which U.S. defense firms will be able to continue to attract and retain world class technical employees (for example, software programmers and data networking engineers) in an era of explosive growth in the civil internet, telecommunications, and high technology sectors, with their relatively high salaries and other compensation options, and cutting-edge research efforts. Of particular concern is maintenance of the experienced engineers and technicians critical to DoD programs.
- Commercial/accounting best practices. Another issue is the degree to which defense firms have adopted, and will adopt in the future, emerging commercial and accounting best practices, including evolving standards of corporate governance.

Finally, as both the sole buyer of defense articles and services and the regulator that sets the rules of defense procurement, DoD bears a special responsibility to continue to consider its own acquisition, fiscal, and other policies, regulations, and practices affecting the industry -- and address those that warrant reform. While DoD has a number of key acquisition reform initiatives underway, it will be important to seek to determine if there are other approaches that could better allow defense firms and DoD to reap the benefits of continued rationalization, increased productivity, and the commercial and accounting best practices utilized in non-defense sectors. The DoD has a Defense Science Board review underway focusing on these issues.

The Department continues to monitor these and other issues. In general, however, DoD believes that the industry supporting defense continues to be capable of generating the investment and skills necessary to provide affordable, innovative, and high quality defense

products. By and large, DoD has been able to preserve competition and innovation while allowing the defense industry to follow a rational course of consolidation.

European Defense Industry Restructuring

Western Europe has not been immune to the budgetary pressures that have driven U.S. defense industry consolidation. Key Western European firms have participated in a series of overarching acquisitions within the last two years.

- In the UK, British Aerospace has acquired GEC Marconi Electronic Systems; the combined firm will operate as BAE SYSTEMS.
- Germany's DaimlerChrysler Aerospace AG (which previously had acquired the Spanish aerospace firm Construcciones Aeronauticas SA) and France's Aerospatiale Matra have announced their intention to merge their defense and aerospace businesses into a combined entity called European Aeronautic, Defense and Space Company (EADS), expected to begin operations in the spring 2000.

BAE SYSTEMS and EADS together will account for roughly 75 percent of all European defense and aerospace prime contracts. These new firms will rival the major U.S. prime defense and aerospace contractors in sales and breadth of product offerings.

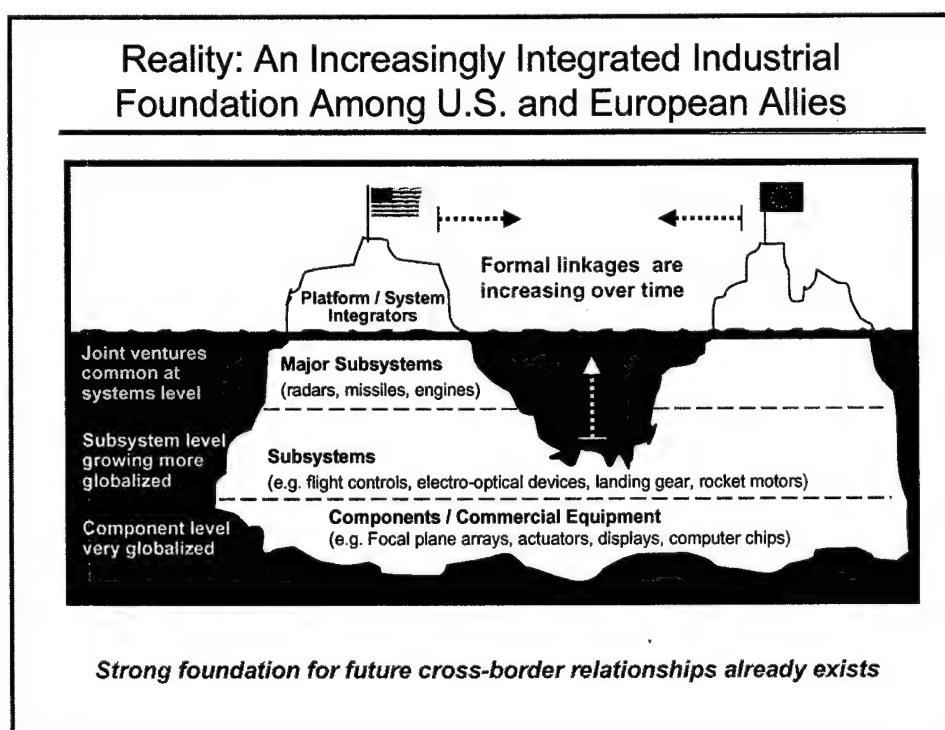
Additionally, existing and new joint ventures have resulted in significant concentration in key defense markets in Europe. Matra Marconi, DaimlerChrysler Aerospace AG, and Italian firm Alenia are combining their satellite businesses to form a pan-European satellite joint venture -- Astrium. France's Alcatel Space (which includes Thomson CSF's satellite business) is the only other major European competitor. The Franco-British missiles company Matra BAE Dynamics (including DaimlerChrysler Aerospace AG's missile business) and Alenia have agreed to form a new missile joint venture -- Matra BAe Alenia. Since BAE SYSTEMS owns 35 percent of Swedish firm Saab's defense and missile business, only smaller, less capable missile firms such as Shorts (UK), BGT (Germany), and Thomson CSF (France) remain independent. There are four major European military aircraft competitors (BAE SYSTEMS, EADS, Saab, and France's Dassault), but they are joined via project joint ventures and equity ownership stakes (Eurofighter, EADS owns 45 percent of Dassault, BAE SYSTEMS owns 35 percent of Saab -- which also owns Swedish firm CELSIUS). This effectively reduces European military aircraft competitors to BAE SYSTEMS and EADS.

There likely will be continued restructuring in Europe. Smaller defense and aerospace firms in Europe face considerable economic and shareholder pressures to join, or align themselves via supplier agreements, with one of the larger industrial groupings.³ As part of the post-merger integration process, large European aerospace prime contractors (taking a page from

³ The French firm RACAL has selected another path. It has announced that it will divest all of its businesses to larger groups such as Thomson CSF.

the books of their U.S. counterparts) are reducing the number of their suppliers and asking the remaining vendors to absorb more development risk and cost, and offer more integrated systems than in the past. These factors are spurring a new wave of consolidation as companies below the platform prime contractor level seek to reach a critical mass and become the dominant supplier in their particular technology niche.

The significant European consolidation activity in 1999 has raised the risks of rival U.S. and European "fortresses" each dominating their respective geographic markets and competing vigorously for international sales in developing country markets (with attendant risks for arms proliferation). The European view is that these industrial restructurings will not result in a "Fortress Europe" marked by political procurement selections and instead are a necessary first step before enhanced transatlantic linkages. As a matter of fact, industrial linkages between the United States and its allies already exist and are increasing. A number of European firms (for example, BAE SYSTEMS, Rolls Royce, Smiths Industries, and Thomson CSF) have significant U.S. footprints and already are transatlantic in character. Additionally, suppliers of subsystems and components already provide products to militaries on both sides of the Atlantic. Joint ventures increasingly are common at the systems level and are spreading to weapons platforms such as the Joint Strike Fighter and the Future Scout and Calvary System. The chart illustrates the current state of transatlantic linkages.



Merged European firms now are faced with the challenge of managing the transitions successfully and achieving the desired industrial rationalization. Successful mergers are difficult even in the best of circumstances (i.e., within national boundaries). As discussed above, major U.S. defense firms have encountered difficulties in producing synergies and efficiencies. The additional political, regulatory, economic and other circumstances that exist in Europe make the

task that much more complex. One factor not to be underestimated is the pressure that increasing public ownership and declining governmental shareholding in European defense firms will bring for bottom-line results; this pressure may drive the merged firms to take actions to meet shareholder expectations.

3.4 DoD's Industrial Objectives

DoD must access and efficiently utilize the best industrial resources available -- defense and commercial, domestic and international -- to obtain the low cost, high performing and innovative products needed to meet U.S. security needs in a changing world. DoD therefore continues to pursue a series of focused policies designed to create an enabling environment in which competitive and robust industrial capabilities can flourish.

Ensure Vigorous Competition in Defense Markets

A central tenet of DoD policy is to ensure vigorous competition in defense markets. It is well documented that such competition produces benefits in terms of cost savings and innovation.

Merger and Acquisition Reviews

The Department's basic policy and practice with respect to defense company mergers and acquisitions remains unchanged. DoD supports the process of supplier rationalization that enables firms to eliminate excess capacity, reduce costs, sustain critical mass in research and development to foster innovation, and provide better value for DoD and the U.S. taxpayer. At the same time, however, the DoD does not support those mergers and acquisitions in defense markets that adversely impact effective competition and innovation for DoD programs and requirements.

In accordance with DoD Directive 5000.62, *Impact of Mergers or Acquisitions of Major DoD Suppliers on DoD Programs*, the Under Secretary of Defense for Acquisition, Technology and Logistics, through the Deputy Under Secretary of Defense (Industrial Affairs) and the DoD General Counsel, are responsible for reviewing defense industry mergers and acquisitions to assess potential impacts on DoD interests. The DoD review is coordinated closely with, depending on the specific case, either the Department of Justice Antitrust Division or Federal Trade Commission. DoD participation in these reviews is an integral element of the Department's broader efforts to oversee the health and suitability of its supplier base. There are four key areas of focus in the DoD review process:

- Will the transaction result in a loss of current or future competition and innovation in defense product markets or for a specific DoD program (for example, through market concentration or loss of an important competitor)?

- Will the transaction have an adverse effect on DoD programs due to vertical integration (for example, one company potentially could control production of certain subtier products -- subassemblies or components -- that are critical to its competitors)?
- Does the transaction present organizational conflicts of interest (for example, a merged entity might be a partner in two different teams competing on the same program)?
- What cost savings/efficiencies might accrue to the Department as a result of the acquisition?

In 1999, the Department formally reviewed 46 transactions (see table on next page). As shown, most of the transactions were approved, one was withdrawn, one was approved but not consummated, DoD opposed two, and four required consent agreements to ensure that continued competition is protected (firewalls to protect proprietary information, agreements not to enforce exclusive teaming arrangements, and divestitures of certain business units).

One 1999 review in which DoD participated involved a proposed defense merger between two non-U.S. firms. Before consummation of the merger, BAE and MES agreed to comply with certain interim undertakings -- until the UK merger review process is completed -- that address competitive concerns related to the joint U.S./UK Future Scout and Calvary System (FSCS/TRACER) Program and the Joint Strike Fighter (JSF) Program. BAE and the former MES are competing prime contractors on the FSCS/TRACER Program and subcontractors on the two competing prime contractor teams on the JSF Program. Required remedial measures contained in the undertakings include a series of information firewalls, investment commitments, financial incentives for key personnel, and oversight mechanisms to ensure robust competition in the affected programs. These undertakings will not become final until the UK Secretary of State for Trade and Industry accepts and publishes them and other undertakings related to this merger. This is expected to occur later this year.

Technology and Acquisition Strategies

It is a fundamental DoD policy to allow market forces to shape the industrial environment to the maximum extent practicable. However, in the emerging consolidated defense industry environment, the number of competitive suppliers is limited for some critical and complex products. In such circumstances, DoD technology and acquisition investment decisions may impact the structure of key defense markets; Department decisions may have a significant effect on *future competition*. Accordingly, DoD is taking steps to: (1) consider the potential effects on future competitive suppliers of important technology and acquisition investments; and (2) take appropriate action in those exceptional cases in which it expects inadequate future competition.

DoD has designated the Deputy Under Secretary of Defense for Industrial Affairs as its leader to consult with the Military Departments, industry, and outside consultants to identify problem areas in maintaining competition and to develop appropriate approaches to address identified problem areas.

1999 Defense Mergers and Acquisition Reviews

Acquiror	Acquiree	Value	Remarks
Lockheed Martin	COMSAT	\$2.7B	
AT&T	BT	\$10B	Consent Agreement
Comptek Research	Amherst Systems, Inc.	\$30M	
Aeroflex Inc	UTMC Microelectronic Systems Inc.	\$46M	
BF Goodrich	Coltec Industries	\$2.2B	
Exxon	Mobil	\$77.2B	Consent Agreement
Litton	Denro	\$60M	
Phillips 66	Ultra Mart Diamond Shamrock	\$800M	Withdrawn
Orbital Sciences	Raytheon's TMS	\$21M	
L3	Microdyne	\$90M	
TRW	Astro Aerospace Corp	\$30M	
Fairchild Corp	Kaynar Tech	\$280M	
FLIR System	Inframetrics	\$46M	
L3	Aydin	\$72.3M	
British Aerospace	GEC Marconi	\$13B	Consent Agreement
Newport News	Avondale	\$470M	Not Consummated
TRW	LucasVarity plc	\$6.6B	
Eaton	Aeroquip-Vickers	\$1.7B	
Honeywell	Boeing MEMS	\$25M	
United Technologies	Sundstrand	\$4.3B	
Northrop Grumman	California Microwave	\$93M	
BP Amoco, plc	Atlantic Richfield Co	\$26.6B	
L3	Interstate Electronics	\$60M	
Veridian	Trident Data	N/A	
Day & Zimmermann	Mason & Hanger Corp	N/A	
Veritas	Sierra Tech	\$50M	
General Dynamics	Gulfstream Aerospace Corporation	\$5.3B	
Precision Castparts	Wyman Gordon	\$825M	
Getronics	Wang Global	\$1.8B	
Litton	Avondale	\$500M	
Litton	Newport News Shipbuilding	\$1.9B	DoD Opposed
General Dynamics	Newport News Shipbuilding	\$2B	DoD Opposed
Northrop Grumman	Ryan Aeronautical	\$140M	
Northrop Grumman	Data Procurement Corp	\$33M	
SAIC	Boeing Information Services	N/A	
GD	GTE Government Systems	\$1.05B	
Meggitt, plc	Whittaker Corp	\$380M	
Allied Signal	Honeywell	\$14.8B	Consent Agreement
McBride & Associates	Marconi Enterprises	\$10.5M	
Veridian	ERIM International	N/A	
Veridian	MRJ Technology	N/A	
Marconi North America	Watkins-Johnson Company	\$57.9M	
Computer Sciences Corp	Nichols Research	\$391M	
ITT Industries, Inc.	Stanford Telecommunications, Inc.	\$191M	
A.P. Moller-Maersk	Sea-Land	\$800M	
Rolls-Royce plc (UK)	Vickers plc (UK)	\$933M	
AlliedSignal	Tristar Aerospace	\$291M	

Note: "N/A" indicates companies are privately held and transaction value is not available

To fully address these issues, the Department will continue to develop profiles of core defense industry sectors to gain insight into industrial and technological capabilities, industry and company structures, supply and demand stability, and innovation. The Department also plans to develop guidelines for acquisition program managers in considering the industrial effects of planned technology and acquisition investment strategies. DoD managers can use these guidelines to: (1) project the effects the planned program may have on other programs and the structure of the industry; (2) project the effects the market structure and pace of technology will have on the planned program; and (3) identify and take appropriate remedial action when necessary. There is a range of possible approaches that can be utilized on a case-by-case basis. Among the competition-enhancing actions available to the Department are: (1) structuring Science and Technology projects to foster multiple industrial sources among defense market incumbents and non-incumbents; (2) employing open systems architectures; and (3) breaking anti-competitive exclusive teaming arrangements.

In recent years, DoD also has experienced problems ensuring the continued availability of key components such as microwave power tubes, radiation hardened integrated circuits, and flat panel display glass. These components must meet unique DoD requirements, are purchased in relatively low volume, and have multi-platform applications. The Department is taking steps to identify and manage these critical niche product areas in a coordinated manner. Furthermore, DoD is pursuing initiatives to forecast niche market vulnerabilities and adapt current mechanisms to coordinate requirements and buying strategies. DoD actions addressing these niche product areas are summarized in Section 5.3.

Promote Civil-Military Integration

If DoD is to acquire affordable systems quickly, in the quantities required, it must pursue non-traditional acquisition approaches, including making full use of integrated commercial/military assembly lines for otherwise defense-unique items. Civil-military integration, eliminating the distinction between doing business with the government and other buyers, is critical to meeting future military, economic, and policy objectives. In order to accomplish civil-military integration of the national industrial and technology base, DoD must adopt the business practices of world-class customers and suppliers and, to the maximum extent practicable, not apply government-unique terms and conditions to its contracts. DoD's civil-military integration objectives are designed to take acquisition reform to a new level by applying long-term emphasis on commercial solutions to military requirements. DoD has developed a strategic plan targeted at reducing the distinction between DoD and other buyers in order to attract commercial companies to the defense sector. The plan includes a set of initiatives, and policy and behavioral and cultural changes that together will enable the Department to achieve its goals.

Enhance Industrial Linkages with Coalition Partners

Strengthened U.S. industrial linkages with key coalition partners in Europe and elsewhere are important to facilitate interoperability among coalition forces, improve coalition warfighting capabilities, and leverage efficiencies and continued competition for defense goods and services.

The rationale for this new and evolving approach is clear. As noted above, the wars of the future are likely to be fought in coalitions that share the burden of resources. However, the weakest link in the coalition leaves all members vulnerable. Accordingly, it is vital to share technology with coalition partners in order to enhance their capabilities and promote interoperability. Industrial linkages facilitate this process.

Similarly, from a competition standpoint, industrial linkages are beneficial. Plainly, a "Fortress Europe - Fortress U.S." industrial environment -- in which a pan-European firm and several large U.S. firms have closed home markets and compete only in the third world -- is not desirable. The Department will be vigilant against and work aggressively to preclude the formation of such an environment and the erection of barriers to U.S. market access.

The Department prefers a "competitive transatlantic industrial model" characterized by industrial linkages among multiple firms on both sides of the Atlantic, competing effectively in both the large European and U.S. markets, and sharing technology -- without compromising the security of classified information and without losing control of important technologies. In this model, both the U.S. and Europe realize the benefits of competition and interoperability, the NATO structure is strengthened, the large U.S. and European markets are open to transatlantic firms, and weapons proliferation incentives are reduced significantly.

Increased multinational manufacturing processes and global information flows present both enticing opportunities and changing security risks. DoD therefore is exploring possible approaches to achieving greater transparency and efficiency in its procedures for export of defense articles and defense services with its allies while maintaining necessary security.

Specifically, the Department is working to create the enabling environment necessary to enhance security-enhancing, pro-competitive defense industrial linkages with potential partners and, in so doing, U.S. security.

Getting the Enabling Environment Right

In order to promote interoperability, DoD will foster closer industrial linkages with countries with which the United States has longstanding cooperative relationships across a broad spectrum of defense activities, including:

- Strict enforcement of export policies for armaments and technologies,
- Strong industrial security systems and compatible industrial security practices,
- Close relationships in law enforcement and cooperation on industrial security matters and export control violations,

- Close relationships in intelligence sharing on matters of counterintelligence and industrial security, and countering economic espionage and export control violations, and
- A willingness to establish reciprocal access to each other's markets.

U.S. - UK Declaration of Principles for Defense Equipment and Industrial Cooperation

Consistent with its intent to foster closer industrial linkages with key allies, the DoD and the UK Ministry of Defence (MoD) have entered into an agreement to improve the environment for defense equipment cooperation and trade by establishing a road map to remove unnecessary administrative obstacles. The Declaration of Principles addresses key areas of interest such as harmonization of military requirements, security of supply, export procedures, security, foreign ownership and corporate governance, and research. For DoD, one of the most important principles is that U.S. industry doing business in the UK should be treated no less favorably than UK industry doing business in the U.S. Officials from the DoD and MoD, with other Departments as appropriate, will begin discussions on the key areas covered by the Declaration, with the goal of finalizing implementing agreements over the next year. These discussions will include reviews of existing agreements in such areas as export control procedures, transfer of information, and access to markets, with a view to improving the way the U.S. and UK do defense equipment and defense industrial business.

DoD has initiated discussions with several other allies on defense equipment and industrial cooperation.

Improving the Regulatory Environment

DoD also is working to improve the U.S. regulatory environment for industrial linkages. DoD's first priority is to reform the export license process to improve security of technology controls and increase interoperability with our allies. This effort, which must be coordinated with the State Department, is the key to the continued health of our defense and non-defense industries. It also is required to correct interoperability deficiencies identified in Kosovo. In addition, DoD is:

- Promoting industrial security by facilitating authorized exchanges of classified information between U.S. firms and reliable foreign firms in countries with congruent policies, while better addressing security vulnerabilities resulting from new technologies and new business structures and practices, and
- Expediting the process to determine whether classified information should be disclosed to a foreign government or company in a manner that does not harm the quality of the decision, but recognizes the need for prompt action in a rapidly changing world.

Several recent examples illustrate DoD's emphasis on establishing an environment that encourages appropriate defense industrial linkages. The DoD did not oppose GEC Marconi's acquisition of Tracor, Inc. As a result of that transaction, GEC Marconi increased its market presence in the U.S. and as a supplier to DoD. In order to permit Thomson CSF to operate effectively in the United States, the Department issued a Special Security Agreement (SSA) to the Thomson CSF aircraft training and simulation facility in Arlington TX. In order to facilitate effective business operations, DoD removed a previous requirement for a separate proxy company so that Rolls Royce could operate its Indiana-based Allison subsidiary under an SSA.

Ensuring Reciprocal Market Access.

Market access that increases industrial linkages and interoperability requires a two-way street. The United States and allied governments must adopt greater reciprocity and be willing to rely on an integrated industrial base for satisfying their defense needs.

DoD is reviewing its acquisition practices that result in the exclusion of foreign sources to determine which practices are antiquated and which still are necessary to protect U.S. national security interests. If DoD expects U.S. companies and multinational companies with a significant U.S. component to have access to the defense markets of its allies in the future, it must show a greater willingness to use companies located in allied countries to satisfy defense equipment needs.

At the same time, DoD also must be vigilant and guard against a Fortress Europe mentality as a consequence of recent consolidations. U.S. firms have participated significantly in European markets in recent years -- to the benefit of interoperability and the Alliance -- and DoD hopes and anticipates that there will not be discrimination against U.S. equipment in the future. DoD will work to devise metrics to monitor the degree to which the European and U.S. markets remain open to all allied defense suppliers.

Facilitating Specific Linkages.

Finally, the Department will encourage and facilitate specific linkages -- joint ventures, teaming arrangements, and other forms of cooperation that will further the nations' national security objectives. This includes both top-down and bottom-up approaches: cooperative programs established by the United States and other countries as well as industry-driven transatlantic collaborations that seek to meet their government customers' needs for interoperable systems. This is of course not a matter for governments alone and the private sector has a critical role to play in developing security-enhancing, pro-competitive ventures.

Maintain Industrial Readiness

Maintaining industrial readiness requires that DoD continue programs designed to develop or improve defense-critical industrial and technological capabilities; and to identify,

adapt and leverage predominantly commercial and dual use capabilities and products for defense applications.

- DoD's *Manufacturing Technology Program* supports the implementation of defense-critical manufacturing processes to improve affordability and facilitate the ultimate success of weapon system programs.
- DoD can use the authorities of *Title III of the Defense Production Act* to provide domestic firms with financial incentives to establish, modernize, or expand domestic production capability and capacity for technology items, components, and industrial resources essential for national defense.
- DoD uses its *Technology Transfer Program* to monitor DoD research and development activities, identify those technological advances that have potential for non-defense commercial applications, and facilitate the transfer of such technological advances to the private sector.
- DoD's *Commercial Operations and Support Savings Initiative* adapts and inserts commercial items into fielded defense systems to reduce operations and support costs.
- Within the *Dual Use Science & Technology Program*, DoD jointly funds research projects with industry that develop dual use technology solutions for DoD problems.
- DoD, with other government agencies, supports the industry-led *Maritime Technology Advanced Shipbuilding Enterprise Program* that leverages the best worldwide commercial shipbuilding business and manufacturing practices to reduce costs and cycle times for Navy warships and to improve the international competitiveness of U.S. shipbuilders.
- The Department co-chairs the *North American Technology and Industrial Base Organization* (NATIBO). NATIBO is chartered to identify and analyze key technology and industrial sectors that are critical to defense, assess the viability of these sectors, identify issues and barriers related to sector viability, and develop strategies to enhance and sustain the health of the marketplace.
- The Army's *Horizontal Technology Integration Program* applies common technologies across multiple weapons platforms to increase mission effectiveness by simultaneously improving performance, encouraging product standardization, and increasing interoperability.

Sections 5.1 and 5.2 contain summaries of 1999 activities associated with these programs.

The Department also conducts industrial capabilities assessments to profile industrial or technological capabilities associated with an industrial sector, subsector, or commodity important

to DoD. DoD industrial assessments: (1) identify the key industrial and technological capabilities required to compete effectively in a particular market area; (2) profile current and potential suppliers that possess those capabilities; and (3) determine the extent to which demand estimates might influence the continued availability of those capabilities.

Section 4 summarizes industrial capabilities assessments, decisions, and actions completed during 1999.

Utilization of Reliable Foreign Suppliers

DoD wants to take full advantage of the competitive benefits offered by access to the best global suppliers. It also wants to promote consistency and fairness in dealing with its allies while assuring that an adequate industrial base is maintained to support defense needs. For this purpose, DoD and many friendly governments have established reciprocal procurement agreements that waive their respective "buy national" laws and put each other's industries on par as potential suppliers. Consequently, DoD often uses foreign suppliers.

At the same time, DoD is not willing to accept foreign vulnerability which poses risks to national security. There are two broad circumstances, both associated with *access* issues, that could merit the exclusion of non-U.S. suppliers:

- When there is an unacceptable risk that DoD would be unable to access the capabilities, services, or products that it needs, when it needs them.
- When DoD must be able to deny to others access to capabilities, services, or products in order to preserve national security.

These conditions are addressed in more detail in DoD Handbook 5000.60-H, "Assessing Defense Industrial Capabilities." This handbook is available on the Office of the Deputy Under Secretary of Defense (Industrial Affairs) website.⁴

3.5 DoD Policies

In 1999, DoD augmented existing industrial capabilities-related policies by issuing new guidance designed to promote competition and increase access to commercial inventories. Additionally, the Army is preparing guidance designed to restrict conventional ammunition procurements to domestic sources when necessary to protect essential industrial and technological capabilities.

Anticompetitive Teaming

As a result of the consolidation of the defense industry, companies competing for DoD business increasingly are entering into exclusive teaming arrangements. An exclusive teaming arrangement is created when two or more companies agree -- in writing, through

⁴ (<http://www.acq.osd.mil/ia/doc.html>)

"understandings," or by any other means -- to team together to pursue a DoD procurement program, and further agree not to team with any other competitors for that program. These teaming arrangements have the potential of resulting in inadequate competition for DoD contracts. While DoD's preference is to allow the private sector to team and subcontract without DoD involvement, there are circumstances in which DoD must intervene to assure adequate competition.

On January 5, 1999, the Under Secretary of Defense (Acquisition, Technology, and Logistics) issued a policy memorandum requiring Department program managers and contracting officers to scrutinize prime or subcontract teaming arrangements for their potential to inhibit competition. The policy memorandum also summarized various actions that Department representatives could take to address competitive concerns arising from that scrutiny.

Subcontractor Competition

Consolidation in the defense industry is resulting in a smaller, high performing group of contractors in which key supplier relationships increasingly are characterized by longer-term contract relationships with consistent performance expectations. Based on this trend, the Department anticipates that it will employ tailored oversight, where appropriate, on subcontracts rather than on subcontractors. This oversight, or more appropriately insight, will ensure that adequate competition, innovation, and quality are achieved to prevent problems that can arise through excess internal vertical integration.

On May 5, 1999, the Principal Deputy Under Secretary of Defense (Acquisition and Technology) issued a policy memorandum requiring Department program managers and contracting officers to consider increasing government insight into the subcontractor selection process when another division of a potential offeror might be a competitor for a particular subsystem. In such cases, the policy memorandum directs DoD representatives to:

- Ask offerors to submit a plan explaining how they will ensure that the subcontractor competition will be conducted fairly and result in the best value for DoD.
- Review that plan to determine if the offeror has taken adequate steps to ensure that a fair competition will be conducted for a specified subsystem.
- Seek appropriate offeror revision of the plan if the government representative concludes that it is likely that the offeror will show bias in the selection of the subcontractor. If bias cannot be mitigated adequately, the government representative is to consider procuring the subsystem as Government Furnished Equipment, but only as a last result.

3.6 Army Policy: Conventional Ammunition

In 1998, as reported in last year's *Annual Industrial Capabilities Report to Congress*, the Army considered new strategies to configure and manage the U.S. munitions industrial base. The Army issued an industrial base policy letter specifying the strategy with which it planned to improve the efficiency of its ammunition procurement programs. Army integrated process teams

for each ammunition family of ammunition items are developing acquisition plans designed to implement this policy. All plans should be complete by spring 2000. Through 1999, the Army has issued three competitive solicitations implementing the evolving plans. Army solicitations for explosives, metal parts for M107 projectiles, and small arms ammunition gave offerors the option to use, or not use, government-owned industrial facilities. In each case, the Army awarded contracts to offerors that planned to utilize existing government-owned facilities to meet projected replenishment requirements.

Section 806 of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 requires that the official in the Department of the Army designated as the Single Manager for Conventional Ammunition shall have the authority to, and shall restrict, conventional ammunition procurements to domestic sources when necessary to protect the base. Accompanying report language (House Report No. 105-736 at page 690) specifies that "This provision supersedes existing guidance issued by the DoD as it relates to the procurement of ammunition from domestic sources. The conferees direct the Department of the Army to issue new guidance to replace the DoD guidance superseded by this provision."

Accordingly, the Army is preparing guidance describing how it will: (1) review planned Army and other Military Department conventional ammunition procurements and (2) ensure such procurements are restricted to domestic sources when necessary to protect essential industrial and technological capabilities. The Army expects to issue this guidance in early 2000. The Department will prepare and issue conforming changes to departmental guidance to support the Army guidance.⁵

3.7 Defense Logistics Agency Policy: Surge and Sustainment

In the past, Defense Logistics Agency (DLA) inventories have played a large role in meeting surge and sustainment requirements. As DLA continues to downsize and reduce its inventories, new strategies are required to assure access to commercial inventories and production capabilities, or other industry-based solutions.

In July 1999, DLA established a policy (Defense Logistics Support Command Procurement Letter 99-09, *Surge and Sustainment (S&S) Requirements*) emphasizing the need to consider S&S requirements in its new business arrangements (for example, corporate, prime vendor contracts and virtual, prime vendor contracts) and long-term contracts. It includes a process for ensuring that S&S capability actually exists, validating the capability through testing, and holding contractors more accountable for meeting S&S requirements.

⁵ DoD's policy is full and open competition to the maximum extent possible. However, DoD has taken action, and will continue to take action, to sustain selected industrial and technological capabilities for which DoD peacetime requirements are limited, and projected military contingency requirements are significantly larger (for example, surge requirements for critical troop support items such as nerve agent antidotes in autoinjectors, or replenishment requirements for specific conventional ammunition end items). In such cases, DoD has restricted competition in a solicitation, for mobilization base reasons, to domestic sources and/or acquired and maintained the facilities, equipment, or components needed to meet projected military requirements.

4. Assessments, Decisions, and Actions

4.1 Introduction

The Department periodically conducts assessments to identify and evaluate those industrial and technological capabilities needed to meet current and future defense requirements. It then uses the results of these assessments to make informed budget, acquisition, and logistics decisions.

"DoD-wide" industrial assessments evaluate and address changes in key component and material providers that supply many programs, and affect competition, innovation, and product availability. The Department periodically conducts domestic source restriction assessments to determine if foreign product restrictions contained in the Defense Federal Acquisition Regulation Supplement that were imposed by a DoD policy decision, not by statute, still are required for national security reasons. Additionally, DoD Components frequently conduct their own analyses when: (1) there is an indication that industrial or technological capabilities associated with an industrial sector, subsector, or commodity important to a single DoD Component could be lost; or (2) it is necessary to provide industrial capabilities information to help make specific programmatic decisions. These assessments generally are conducted, reviewed, and acted upon internally within the DoD Components.⁶

4.2 Army

Army Science Board Small Arms Production Study (September 1999)

Section 809(e) of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999, required the Secretary of the Army to conduct an Army Science Board study to examine whether the requirements of Section 2473 of Title 10 of the United States Code (to procure small arms repair parts and modifications of parts from a defined production base composed of the current small arms producers) should be extended to cover procurements of small arms themselves and their parts. The Army Science Board concluded that:

- Some specialized processes and know-how exist in the defined small arms production base, but
 - Legacy technology can be replaced and/or improved by modern manufacturing methods at an acceptable cost in money and time.
 - Companies outside the defined base are developing new technology.
 - There is capability available from international companies.

⁶ In some cases, the Defense Logistics Agency's Defense Contract Management Command assists DoD Components by utilizing its broad knowledge across industrial sectors and its on-site presence in many contractor industrial facilities.

- There is insufficient rationale to justify attempting to preserve the defined production base.
- Improvements are required in the overall parts acquisition and weapon repair process. These can be achieved by cooperative Army-industry efforts to upgrade technical data packages and develop contracting approaches that best meet future anticipated needs.
- Congress should not extend the current restriction to all future procurements of small arms end items.
 - The actual production base extends beyond the defined firms.
 - Preservation of existing capabilities should not be the major long-term goal.
 - Recent improvements in information and manufacturing knowledge are rapidly reducing the value of historical skills and knowledge.
- The loss of capabilities resident in the defined production base will not cause the development or production of existing small arms to be time or cost prohibitive.
 - If key legacy capabilities were lost before planned new technologies are adopted, full scale production of certain small arms would require several tens of millions of dollars and about a 2-year ramp up.
 - This is not prohibitive in cost or time.

The Army accepted the results of the study and provided them to the appropriate Members of Congress.

Fiscal Year 1999 Ammunition Base Assessments (March and September 1999)

The Ammunition Base Assessments allow Army leaders to identify and address issues that impact Army plans and programs. It also provides a vehicle and forum to exchange information between the Army and industry. The fiscal year 1999 assessments were designed to:

- Identify ammunition requirements to support the U.S. defense strategy, in consonance with the Defense Planning Guidance.
- Review the replenishment planning methodology.
- Examine the ability of the production base to offset projected fiscal year 2005 war reserve inventory shortfalls.
- Review the viability of the Army's active and inactive government-owned ammunition plants.

The Army assessment found that:

- Recurring peacetime ammunition production sustains most essential industrial capabilities (skills and processes) and reduces new production startup lead-times.
- By fiscal year 2005, based on current procurement plans, there still will be war reserve shortfalls for 78 items. Of these, 45 items are projected to have war reserve shortfalls of 50 percent or more (representing an unfunded requirement of \$11 billion).
- Projected production capacities can offset about 14 percent of the war reserve inventory shortages.
- Projected replenishment times for 20 (of 171) planned ammunition end items and 302 associated critical components exceed 36 months.

The Army is undertaking several actions to address the identified risk areas. It is using acquisition strategies to identify unneeded organic industrial facilities in order to reduce excess capacity and the ownership costs of those organic facilities. (Savings could be applied to unfunded identified ammunition requirements.) Additionally, the Army is reviewing the accuracy of its replenishment methodology and replenishment requirements and schedules.

Plant Equipment Package/Army Reserve Plant Analysis (December 1999)

This review focused on the conventional ammunition industrial base, composed of government-owned and contractor-owned equipment and facilities. To ensure its requirements are met, the Army employs entire government-owned installations (Army Reserve Plants, or ARPs) and government-owned plant equipment packages (PEPs) that it provides to private sector producers. The Army periodically reviews its requirements to determine if such government-owned facilities and equipment still are needed to meet its current and projected requirements. Today, the Army owns 15 ARPs and 16 PEPs (down from 27 and 56, respectively, in 1991). As a result of this assessment, the Army decided to retain a limited number of ARPs and PEPs, and to dispose of four PEPs. The Army will continue its review of the balance of its ARPs and PEPs.

Medium Caliber, 25 and 30mm Multiyear Procurement (August 1999)

This assessment was designed to determine if the Army should use other than full and open competition to award multiyear (fiscal year 1999 - 2003) contracts for 25mm and 30mm *training* ammunition. The 25mm cartridges are used on the Bradley Fighting Vehicle and various U.S. Navy applications. The 30mm cartridges are used on the Apache helicopter. The Army determined that it should restrict the procurement to domestic sources and awarded multiyear contracts to Alliant Techsystems and Primex Technologies. In total, the two contracts are valued at \$253.7 million (\$71.3 million total for the first year and \$182.4 million for option years).

25mm Combat Ammunition Procurement (August 1999)

This assessment was designed to determine if the Army should award a sole source contract for 25mm *combat* ammunition to the current producer, Primex Technologies. The 25mm cartridges use depleted uranium penetrators and will sustain industrial capabilities for those penetrators during a production gap for 120mm tank combat cartridges until the next generation of tank combat rounds goes into production in 2003. The Army awarded a fiscal year 1999 contract, plus two option years, to Primex Technologies. Total cost, including all options, is \$65.6 million.

Small Caliber Ammunition Acquisition and Operations and Maintenance of Lake City Army Ammunition Plant (July 1999)

Consistent with its policy (see Section 3.3) to use acquisitions to configure and manage the ammunition industrial base, the Army conducted a two-part unrestricted competition for: (1) small caliber ammunition procurement, and (2) operation and maintenance of the Lake City Army Ammunition Plant. The procurement portion of the solicitation included 44 different types of small caliber ammunition. The operations and maintenance solicitation encouraged offerors to recoup facility costs by marketing facilities not needed for the procurement contract to third parties. The Army awarded two separate contracts, cumulatively valued at \$1.1 billion, to Alliant Techsystems. The procurement contract is fixed price (with an economic adjustment for the price of copper) for one year, with nine separate and evaluated option years. The second contract is a 25-year, no cost contract to operate and maintain the Lake City facility. Procurement contract prices are approximately 20 percent less than were budgeted.

120mm Tank Training Ammunition Multiyear Contract (February 1999)

This assessment was designed to determine if the Army should use other than full and open competition to award a multiyear (fiscal years 1999 - 2003) contract for 120mm Tank Training Ammunition for Army and Marine Corps applications. The Army determined that it should award restricted competition contracts to both current producers (Alliant Techsystems and Primex Technologies) to sustain those industrial and technological capabilities required to produce tank combat ammunition. Total value of the two contracts was \$771.3 million.

155mm M107 Metal Parts Multiyear Procurement (August 1999)

This assessment was designed to determine if the Army should use other than full and open competition to award a multiyear (fiscal year 1999 - 2003) contract for metal parts for the M107 projectile. The M107 is both a war reserve item and training round for Army and Marine Corps 155mm howitzers. The Army determined that it should restrict the procurement to domestic sources and awarded a multiyear contract to the Chamberlain Manufacturing Co. to sustain essential U.S. industrial capabilities for large projectile metal parts, specifically for long stroke pressing capacity.

Fuze Production Base Assessment (January 1999)

Military fuzes have two functions; they initiate warhead detonation when predetermined conditions are met and preclude unintended warhead detonation. This assessment was designed to determine if available industrial and technological capabilities were sufficient to meet current and projected Army fuze requirements. Seven private suppliers and two government-owned, contractor-operated (GOCO) suppliers produce military fuzes. Traditionally, private fuze suppliers produce metal parts and GOCO suppliers load, assemble, and pack the fuzes. The assessment concluded that:

- Current production capabilities are sufficient to meet all peacetime requirements and, except for the self-destruct submunition fuze, projected replenishment requirements.
- The self-destruct fuze is used in Dual Purpose Improved Conventional Munitions projectiles and in Multiple Launch Rocket System rockets.
- Projected replenishment requirements can be met only by adding production capacity totaling 190,000 fuzes per month.

The Army decided against establishing additional production capabilities at GOCO facilities. Instead, the Army awarded a 50 percent cost-sharing contract with Action Manufacturing Co. to establish production capability sufficient to meet projected replenishment requirements.

There are a limited number of suppliers for certain key components. The Army will monitor these risk areas:

- Two suppliers of reserve batteries.
- One supplier for millimeter wave monolithic integrated circuit components for gun-hardened applications.
- One qualified supplier of gun-hardened crystal oscillators for electronic fuzes.
- One qualified supplier of liquid crystal displays for military fuzes.
- One supplier of turbine alternators for mortar and bomb fuzes.

Armored Systems Modernization Study (February 1999)

The Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 and the Fiscal Year 1999 DoD Appropriations Act directed the Army to review heavy tank and armored fighting vehicle upgrade programs to determine if projected program terminations would adversely impact the availability of needed armored systems industrial and technological capabilities. The report concluded that:

- Current upgrades and limited new procurements are sufficient to maintain industrial and technological capabilities for the near-term.
- For the period 2005 - 2015, after completion of the Bradley M2A3 upgrade and the Abrams M1A2 system enhancement programs, remaining Army requirements are uncertain. The end of these programs likely will affect 2nd and 3rd tier vendors and may lead to increased costs to qualify new vendors. Additionally, prime contractors' system engineering and design skills may be eroded.

As Army requirements change the Army will assess, during deliberations associated with its Future Combat Vehicle Development process, the disposition of underutilized and excess industrial capacity. The Army will consider current and emerging threats; industrial base impacts; potential technological advances; and projected layaway, disposal, and reconstitution timing and costs. The Army is updating its Armored Systems Modernization study and will report the results to Congress later this year.

Army Missile Sector Update (August 1999)

The Defense Contract Management Command's Industrial Analysis Support Office performed this assessment for the Army. The assessment concluded that industry consolidation coupled with increased missile production has resulted in several missile sector issues and risk areas.

- Sub-component lead-times frequently exceed weapon system production lead-times. Long lead item purchases are required.
- Sub-component maximum production rates frequently are less than weapon system production rates.
- As work transitions to new facilities (due to industry consolidation), reestablishing key skills will increase lead-times and impact production rates.
- Production plans must reflect increased lead-times associated with the re-establishment of cold production lines. Mature missile systems require redesign and requalification to overcome issues associated with obsolete parts and sub-components.
- Test equipment shortages can cause bottlenecks and may limit production rates for individual programs.
- Conflicting production plans among missile programs (including classified programs) may have to be prioritized.

The Army will monitor and address these risk areas within the context of its missile programs.

Army Tactical Missile System - Brilliant Anti-Armor Submunition Assessment (August 1999)

The Army performed this assessment to identify risk areas associated with the industrial and technological capabilities required to produce the Army Tactical Missile System - Brilliant Anti-Armor Submunition (ATACMS-BAT) Block II. The Block II configuration, except for the warhead, essentially is the same as the Block IA configuration for which production capabilities have been demonstrated. To reduce program risk, the Army is developing second sources for several key ATACMS-BAT Block II components: thermal batteries, the motorcase, and the Global Positioning System antenna.

The Army will continue to monitor potential industrial capabilities risk areas as the program goes forward.

Army Aviation Sector Update (August 1999)

The Defense Contract Management Command's Industrial Analysis Support Office performed this assessment for the Army. This assessment was designed to determine if industry consolidation has impacted the industrial and technological capabilities necessary to meet DoD's current and projected rotary wing aircraft requirements. The assessment determined that:

- The Army's RAH-66 Comanche helicopter and the Navy's V-22 Osprey tilt-rotor continue to drive rotary wing leading technologies.
- All three prime integrators (Bell, Boeing, and Sikorsky) have the requisite industrial and technological capabilities to support current and planned programs. Each has a strong presence in DoD, commercial, and foreign military sales.
- Significant restructuring of the RAH-66 or V-22 programs could lead to further industry consolidation.

Cast Beryllium Aluminum Components (July 1999)

In 1999, a sole source supplier of several large-scale cast beryllium aluminum (BeAl) components for the RAH-66 Comanche helicopter asked the Army to provide extraordinary relief to preclude the need for the firm to exit the business. The Army determined that there were alternate commercial suppliers, with slightly less capability but strong business prospects. The Army decided that it did not need to take special action to preserve the supplier.

Assessment of the Electro-Optics Image Intensifier (October 1999)

The Defense Contract Management Command's Industrial Analysis Support Office performed this assessment for the Army. The assessment was designed to determine if there were sufficient industrial capabilities and capacities to meet Army requirements for Generation III (GEN III) image intensifier tubes, specifically to meet surge and mobilization requirements. Only two suppliers (Litton Electro-Optical Systems) and ITT Night Visions are qualified to

produce GEN III image intensifier tubes. The assessment concluded that these contractors possess sufficient capacity to meet the Army's peacetime and projected surge/mobilization requirements.

Information Technology Assessment, Phase II (October 1999)

This assessment was conducted jointly by the Army and the Defense Contract Management Command's Industrial Analysis Support Office. It was designed to evaluate key information security industry subsector areas (virus protection, firewalls, encryption, intrusion detection, host vulnerability, and smart/fortezza cards). The majority of information security and products used for Army applications are commercial off-the-shelf.

The Army previously had identified five companies that exhibited signs of financial weakness. The team performed financial viability assessments for these firms. Of the five companies, one was judged to be low risk, three moderate risk, and one exited the business. The firm that exited the business was one of several sources; there was no impact on overall competition or product availability. The team did find that there is only one domestic manufacturer for the thin film transistor substrate used in active matrix liquid crystal displays. However, commercial demand appears to be stable or increasing; and the technology continues to advance.

The assessment concluded that the industrial capabilities supporting the sector are strong. Most information security products and services are developed for commercial applications. Demand is increasing and there is a robust technological environment.

4.3 Navy

Overview of Navy Private Sector Shipbuilding (February 1999)

The Navy prepared this overview to provide information for congressional staff personnel during budget hearings. The overview considered current and projected new construction, conversion, refueling, overhaul, and repair workloads at the six major private sector shipyards, for the period 1999 - 2007. The six major private sector shipyards engaged in U.S. Navy business are Newport News Shipbuilding and Dry Dock Co., General Dynamics' Electric Boat Division, Ingalls Shipbuilding, General Dynamics' Bath Iron Works, Avondale Industries, and National Steel and Shipbuilding Co. For each shipyard, the Navy summarized military and commercial ship programs, and employment. The review confirmed that, overall, workload and employment have declined; and planned Navy workload in the period 2000 - 2005 is not projected to be sufficient to maintain total employment at the present levels. Newport News Shipbuilding and Avondale have captured some commercial new ship construction, but future prospects remain limited.

Amphibious Assault Ship Steam Propulsion Plant Components (March 1999)

Only one amphibious assault ship (LHD 7) remains under construction, at Ingalls Shipbuilding. The contract was awarded in 1996; delivery is scheduled for 2001. The Navy

projects that the contract for the next amphibious assault ship (LHD 8) will be awarded in 2005, resulting in a production gap of approximately nine years. Most non-nuclear-powered Navy ships utilize gas turbine engines for propulsion. The LHD-series ships use steam propulsion. This assessment was designed to determine if the industrial and technological capabilities needed to produce steam propulsion plant components for Navy ships would be sustained until projected LHD 8 contract award in 2005. The Navy assessment addressed main steam boilers, main propulsion steam turbines, piping, valves, condensers, forced draft blowers, main feed and booster pumps, main condensate pumps, deaerating feed tanks, and main circulating pumps. The assessment found that there likely would be multiple experienced competitors available for all components. Projected component lead-times range from 10 months for forced draft blowers, to 24 months for main steam boilers, to 40 months for main propulsion steam turbines. The Navy concluded that there would be sufficient competition, capabilities, and capacity available to meet LHD 8 steam propulsion requirements, even after a nine-year production gap.

Shipbuilding Technology and Industrial Base Assessment for the Auxiliary Dry Cargo Carrier (May 1999)

The Auxiliary Dry Cargo Carrier (T-ADC(X)) will provide logistics support to naval forces at sea by transferring supplies (ammunition, spare parts, and provisions) from ports or merchant ships to ships in naval battle groups. The T-ADC(X) also will have the capability to remain on station with the battle groups, if required. The Navy conducted this assessment to identify and quantify areas of risk that could negatively impact T-ADC(X) construction in order to provide information supporting a decision to enter into engineering and manufacturing development. The Navy evaluated major shipboard system developers and integrators, large and smaller shipbuilders, and a sample of critical component and equipment manufacturers. The assessment concluded that:

- Available industrial and technological capabilities (facilities, processes, technologies, and capacities) are sufficient to meet T-ADC(X) requirements; overall program risk is low.
- Industry consolidation seems to be resulting in an increasing emphasis on commercial practices and products that could allow key suppliers to expand markets, increase the pace of technological evolution, and improve product affordability.
- The administratively-imposed Defense Federal Acquisition Regulation Supplement domestic source restriction on ship propulsion shaft forgings (discussed in last year's *Industrial Capabilities Report to Congress*) continues to be necessary to sustain those U.S. ship propulsion shaft capabilities required to meet Navy requirements.

The Navy will continue to identify, evaluate, and address areas of industrial and technological concern as the program advances.

New Aircraft Carrier Facility Limitations Assessment (June 1999)

The Navy expects to award the construction contract for its next nuclear-powered aircraft carrier (CVN 77) in 2001. Final CVN 77 hull characteristics (for example, length, beam, draft,

and displacement) have yet to be determined. The Navy conducted this assessment to determine if existing dry-dock facilities would accommodate eventual CVN 77 major repair and overhaul projects such as shaft replacement, propeller replacement, or hull damage repair. The assessment evaluated current facilities (size and weight capacity of dry-dock positions, shipyard crane capacity at dock positions, and navigational restrictions) at Newport News Shipbuilding, Puget Sound Naval Shipyard, Norfolk Naval Shipyard, and Pearl Harbor Naval Shipyard. The review concluded that none of the facilities currently have the dry-dock capabilities necessary to support projected maintenance requirements for all potential hull designs. The Navy will use the results of this assessment to plan appropriate facility modification projects if it selects a hull design that cannot be accommodated in current facilities.

CH-53E Super Stallion Helicopter Industrial Base Assessment (September 1999)

The CH-53E Super Sea Stallion Helicopter is the only helicopter capable of lifting cargo equivalent to its own weight. It provides "Heavy Lift" capabilities for the Marine Corps. The Navy purchased one CH-53E in 1998 and none in 1999. The Turkish government had planned to purchase eight CH-53Es directly from Sikorsky, beginning in the spring 1999. Navy and Sikorsky personnel had anticipated that such sales would offset the impact of reduced DOD procurements, allowing the helicopter prime contractor, suppliers, and vendors to maintain their production lines. The Turkish government did not purchase the helicopters. Navy program office and Sikorsky personnel are participating in a "smart shutdown" of the production line to minimize the costs and delays associated with potential new production. The smart shutdown includes preserving and storing special tooling in Granite City, MO.

Due to the age of the CH-53E and limited new production, for the past several years the Navy has experienced increasing obsolescence problems with key mechanical components. To facilitate a long-term solution, CH-53E and H-60 Navy program office personnel are pursuing a Rapid Prototyping Initiative with Department of Commerce Electronics Commerce Resource Centers. These centers have developed new methodologies using a 3-dimensional laser computer-aided design program that enables reproduction of the component using stereo-lithography prototyping techniques. The stereo-lithography-generated reproduction is used to perform form, fit and clearance checks before procuring or fabricating materiel for actual use, thereby cutting lead times from 50-70 weeks to 3-4 weeks.

Joint Stand-Off Weapon Industrial Base Assessment (September 1999)

The Joint Stand-Off Weapon (JSOW) is an air-to-surface precision guided tactical munition with stand-off and adverse weather capabilities. It employs an inertial navigation system coupled with a global positioning system to improve accuracy. The JSOW prime contractor, Raytheon, (formerly Texas Instruments) began low-rate initial production in 1998. The Navy conducted assessments in 1997 and 1998 to identify and evaluate manufacturing and component issues that might adversely impact JSOW production. The results of those assessments were summarized in previous reports. The Navy updated its assessment in late 1999. The updated assessment confirmed that the areas identified in previous assessments required continued monitoring.

- Raytheon selected Ametel Corporation to be the sole source supplier of a key integrated circuit used in the JSOW global positioning system. Ametel replaced the original supplier that had left the business. The new circuits now are undergoing rigorous testing.
- Schott Glass Technologies is the sole source supplier of Zerodur glass, a critical component for the inertial measurement unit (IMU). This manufacturer is the only qualified manufacture of this glass and requires continued monitoring.
- Kearfott Guidance and Navigation, the IMU supplier, has moved 85 percent of its JSOW IMU production to Mexico. The Navy, citing NAFTA and World Trade Organization guidelines, did not oppose the move.
- Granaria Holdings B.V. of the Netherlands has acquired Eagle-Picher Industries, a sole source provider of NiH₂ batteries. Eagle-Picher has a dominant market share in advanced batteries, and is the only supplier qualified to produce special duty cycle thermal and sea water activated batteries for various DoD missile systems -- including JSOW. DoD did not oppose the acquisition. Granaria Holdings committed to continue producing products for DoD and restructured Eagle-Picher to create a separate limited liability corporation to perform classified contracts.

JSOW production has not been disrupted. Raytheon is delivering products conforming to specification, on time. The program office will continue to monitor developments associated with Schott Glass, Kearfott, and Eagle-Picher.

Tomahawk Cruise Missile (December 1999)

U.S. operations in Kosovo significantly depleted the Navy's Tomahawk IIID (non-nuclear cruise missile) inventories. To rectify this situation, the Congress increased Tomahawk program funding levels for the purpose of remanufacturing (converting) Type II (nuclear tipped) Tomahawk Cruise Missiles to the Type IIID configuration. This assessment was designed to identify issues that could impact plans to remanufacture those missiles.

Major concerns that might impact program cost and schedule include reopening the production line, re-certifying production processes, and parts obsolescence. Most subcontractor production lines have been shut down and would need to be restarted. Raytheon, the prime contractor, estimated a two and one half-year lead-time after contract award to deliver the first remanufactured missile. The Navy had experienced problems with parts obsolescence even before the last Tomahawk IIID Cruise Missile was delivered.

The assessment concluded that Block III missile production to replenish inventories is feasible but would be difficult. Navy and Raytheon personnel now are taking steps to reestablish the production capabilities necessary to replenish Tomahawk IIID inventories.

4.4 Air Force

Suppliers of Silicon-on-Sapphire and Sapphire Substrates (February 1999)

Silicon-on-Sapphire (SOS) represents a critical material technology with applications in military infrared detection systems, military-grade radiation hardened integrated circuits, commercial Light Emitting Diodes (LEDs), and commercial infrared/optics products. The Air Force conducted this assessment to characterize the manufacturing base for SOS and other sapphire substrates. The assessment: (1) identified both domestic and foreign producers, (2) quantified the market share and production capability of each producer, and (3) identified the process technology in place (i.e., commercial vs. military grade products) at each manufacturer.

The Air Force found that the domestic manufacturing base for SOS is strong, primarily because of a Defense Production Act Title III project conducted in the mid-1990s.

- There are two producers of silicon on sapphire (Union Carbide and Kyocera).
- There are three dominant producers of sapphire substrates, with Union Carbide claiming 70 percent of the market. Seven other companies produce sapphire substrates, but they account for less than 3 percent of the total market.
- Another 20 companies utilize SOS or sapphire substrates to fabricate components for either commercial or military application.
- While the process technology for commercial products differs from military requirements (for example, 2-inch diameter vs. 6-inch diameter single crystal wafers), most producers can manufacture both.

The Air Force concluded that silicon on sapphire and sapphire substrates are mature technologies and are available from the industrial base in sufficient quantity and quality to meet DoD's weapon system requirements, particularly in radiation hardened electronics for space systems. However, the assessment concluded that the manufacturing base supporting sapphire-based material is sufficiently different from that associated with the manufacture of Silicon-on-Insulator material that DoD should proceed with a Title III project designed to improve domestic SOI production capabilities.

This assessment confirmed that the Title III program can play a role in establishing sustainable and competitive domestic production capabilities. The Air Force also used the knowledge gained from the assessment to support the ongoing activities (see Section 6.3) of the DoD Radiation Hardened Electronics Oversight Council.

Radiation Hardened Electronics Availability (August 1999)

DoD satellites and missiles are required to function in more severe radiation rate and dose level environments than commercial satellites and launch vehicles. They must be able to withstand the effects of naturally occurring radiation found in space and also the extremely high

radiation levels that might occur as a result of a nuclear weapon burst. Low military demand has significantly reduced the number of manufacturers in this market. Mergers, divestitures, and funding shortfalls also have contributed to an unsettled industrial environment for radiation hardened electronics. This assessment was designed to: (1) evaluate the availability of radiation hardened electronics to meet DoD application requirements; and (2) determine if systems solutions – including redundancy, error detection and correction, and shielding could reduce DoD's need for radiation hardened electronics. The Air Force concluded:

- Systems solutions may be available to decrease DoD's overall need for radiation hardened electronics.
- Potential systems solutions should be identified and compared.

As a result of the assessment, Air Force electronics technology investment planning teams are prioritizing potential systems concepts, factoring radiation hardening requirements into advanced program concepts, and structuring research and development programs to examine promising system approaches. Finally, the Air Force is developing radiation hardened electronics technology road maps that will be presented to the DoD Radiation Hardened Electronics Oversight Council.

Lower Microcircuit Operating Voltages (September 1999)

Five-volt integrated circuits have been the de facto industry standard for nearly 30 years and have been widely used throughout the military and commercial electronics industry. Today, driven by consumer requirements for small, portable, highly functional, electronic products, integrated circuits for commercial applications are operating at lower voltages (less than 1.8 volts). As lower voltage devices become more dominant in commercial electronics, many of the five-volt devices used in military systems will become unavailable. This assessment was designed to determine how the lower operating voltage trend will impact DoD electronic systems and to identify how to deal more effectively with and mitigate those impacts. The assessment concluded:

- Lower voltage devices, when substituted for higher voltage devices, have a direct impact on the performance characteristics of the overall system.
- Government, industry, and academia should establish a cooperative effort to investigate the long-term reliability of low voltage devices.
- DoD should work with commercial and defense industry representatives to develop bus standards and architectures.

The Air Force's Electronic Systems Center is working with industry and other DoD organizations to coordinate specific recommendations resulting from this assessment. It has conducted or planned joint government/industry workshops focused on low voltage issues related to electromagnetic interference and electromagnetic counter effects, long-term device

reliability, and diminishing manufacturing sources related to lower voltage component integration.

Evidence of Lean Site Visits Interim Report (September 1999)

The Lean Aerospace Initiative (LAI) has been providing a research base for cost-efficient and cost-effective ("lean") development, manufacturing and business practices to both government and industry for over six years. This report identified those lean practices that were being implemented by the aerospace industry and determined how broadly those practices had been diffused across the sector. The Air Force gathered the information during a series of one-day visits to company work sites. The report highlighted significant progress and identified notable practices that merited dissemination.

- In the area of product development, design cycle times have been reduced by 50 percent; and there have been corresponding reductions in man-hours, software development costs, and engineering changes after release.
- On the factory floor, 50 percent reductions in cycle time have been accompanied by reductions of 70-90 percent in inventory, nonconformance costs, assembly support labor, and floor space.
- Of 12 overarching practices defined in the lean enterprise model:
 - Internal product and information flow practices were rated as areas of high implementation.
 - Maximizing personnel and maintaining momentum in improving existing processes were rated as showing medium implementation.
 - Improved external relationships between customers and suppliers were identified as the area where the greatest improvement was needed.

The LAI research consortia, industry planners, and government investment program managers have used report information to allocate resources to establish targeted projects to improve external relationships, including system requirements definition, supply chain strategies, and human resource management.

Repair Parts Supply Enhancement Initiative (September 1999)

In this assessment, Warner Robins Air Logistics Center (WRALC) personnel examined repair parts usage and price data for the C-5, C-130, and F-15 aircraft. The assessment was designed to determine if low cost/high usage parts such as rivets and washers should be managed differently than a high cost/low usage part such as a landing gear. The Air Force analyzed records of repair parts issued to aircraft at WRALC over a one-year period, segregating the data by aircraft type, parts costs, and parts usage. The assessment found that:

- Overall, less than 20 percent of the listed repair parts account for 90 percent of the value of total repair parts for any given aircraft.
- At a cost of 3-9 percent of the repair part budget, 90 percent of all needed repair parts could have been placed in stock at the start of the fiscal year.
- Low usage parts, primarily manufactured parts used one or two times per year, represent 28 percent (C-5) to 45 percent (F-15) of the quantity of stock items used in a year. Although, the availability of parts, not funds, is the key link to meeting repair and overhaul schedules (and operational effectiveness), low usage parts are acquired only after a mechanic initiates a request.

The Air Force concluded:

- High usage/low cost parts (representing 53 percent of the total quantity used and 2 percent of parts dollars) should be bought and become "bench stock." The cost in production delays when these parts are not available is many times higher than the investment required to stock them. Minimal continuous management attention is required; outsourcing or Prime Vendor strategies for these parts are appropriate.
- High usage/high cost parts (4 [C-5] to 19 [C-130] percent of the items and 3 - 9 percent of the costs, respectively) should be maintained at appropriate stock levels and require low-level continuous management attention.
- Low usage/high cost parts (1 percent of the parts and 87 percent of the dollars) require a high level of continuous management attention.
- Low usage/low cost parts should be stocked at special "buffer" levels established by maintenance personnel for each part, purchased by central supply, and issued per schedule requirements.

WRALC has programmed \$5 million to implement a "Buffered Just in Time Replenishment" system for low usage/low cost parts, has established new inventory levels for those parts, and is buying the parts needed to reach the new levels. The Air Force projects that adoption of the recommendations resulting from this assessment will lead to 98 percent parts availability per schedule requirements.

High Energy Laser Industrial Base and Manufacturing Technology Issues and Priorities (October 1999)

This study assessed the capability of the industrial base to develop the technology and manufacture the quality and quantity of hardware required for various high-energy laser (HEL) weapon systems. Specifically, the study focused on the critical technologies required to produce the Airborne Laser, the Space-Based Laser, and the Ground-Based Laser. For each technology, the Air Force evaluated product/material resources, engineering and development, manufacturing processes, measurement equipment, facilities, and personnel. Each of these systems is at a

different stage of definition and development. Thus, the timing for needed industrial capabilities is different for each system. The study concluded that prototypes for the critical technologies either exist or are being developed. However, if these systems move into engineering, manufacturing and development, and then into production, significant industrial issues will need to be addressed:

- Establishing suppliers for certain technologies,
- sole source suppliers for other technologies,
- scale-up of manufacturing capabilities for full-rate production,
- scheduling concerns due to material or manufacturing lead times, and
- producibility and cost concerns.

The Air Force has identified areas requiring manufacturing technology assistance and outlined appropriate technology programs. Additionally, the results of the study may be used to define initiatives to reduce the cost and schedule, increase the reliability, and improve manufacturing capabilities associated with these systems.

Advanced Communications Antenna Manufacturing and Industrial Base Analysis (October 1999)

The increase in data gathering capabilities of surveillance aircraft and the goal of transferring data to/from command centers in real-time requires improved high data rate communication systems. In early 1999, the Air Force demonstrated the capability of high data rate, receive-only airborne wide-band satellite communications technology. Although successful, the communications system was incomplete since the antenna lacked a transmit capability. This assessment was designed to analyze airborne antenna technology capabilities within the industrial base to identify likely candidates for such a fully functional antenna. The Air Force evaluated antenna technologies suitable for mounting on wide body aircraft (dish, solid state transmit/receive modules, passive radiating/receiving elements, and microwave lenses) for maturity, availability, and cost.

The Air Force selected the Luneberg lens as the "best buy" approach for a demonstration. Luneberg lenses are hemispherical structures fabricated from polystyrene that refract microwave energy. They are available at a relatively low cost and are available to meet the program office's timetable for testing an airborne transmit/receive capability.

The Air Force acquired six lenses and shipped them to the antenna integrator for incorporation into a demonstration transmit/receive antenna system. The Air Force expects to begin airborne testing in 2000.

4.5 Defense Logistics Agency

Nerve Agent Antidote in Autoinjectors Follow-on (January 1999)

Nerve Agent Antidote (NAA) in Autoinjectors is a military-unique item designed for rapid self-administration through clothing upon exposure to a nerve agent. DoD uses two styles of autoinjectors -- Atropen and Combopen. Both are front-end activation injection devices. Atropen-style autoinjectors use a stainless steel cartridge to inject atropine. Combopen-style autoinjectors use a tempered glass cartridge to inject Pralidoxine Chloride or Diazepam. The Army uses Atropine and Pralidoxine Chloride autoinjectors packaged together in "Mark I" kits. The U.S. Food and Drug Administration (FDA) must approve the antidotes, autoinjectors and manufacturing processes. This assessment was designed to determine if there were sufficient industrial capabilities for NAA in autoinjectors to meet DoD requirements. The assessment concluded:

- To comply with Title 10 U.S.C section 2534, DoD restricts the purchase of chemical weapons antidotes contained in automatic injectors or components for such injectors, to those manufactured in the U.S. and Canada.
- Although peacetime requirements are low, NAA in autoinjectors must be available quickly, in large quantities, in the event of a military contingency. Peacetime requirements are insufficient to sustain a source of supply.
- Quantities required to meet mobilization requirements greatly exceed peacetime needs.
- Meridian Medical Technologies, Inc. (MMT) is the only FDA-approved manufacturer of NAA in autoinjectors.
- There are no viable alternative sources of supply. Significant barriers to entry (including small demand in peacetime, significant investment in plants and equipment, and a time-consuming FDA approval and re-certification process) discourage potential new suppliers.
- An Industrial Base Maintenance Contract (IBMC) continues to represent the most cost-effective approach to sustain the sole FDA-approved manufacturer in order to provide the required wartime production capability.

DLA has had an IBMC with MMT since 1992. The contract ensures that a valid capability to manufacture NAA in Autoinjectors will be maintained despite unstable peacetime demand. The IBMC requires that MMT maintain a capable workforce and facilities sufficient to meet surge requirements. In 1999, DLA awarded MMT a \$12.3 million one-year IBMC that also included an 8-month extension to an existing contract.

Chemical Protective Suit Liner Fabric Follow-on (November 1999)

The Battle Dress Overgarment (BDO) chemical-protective ensemble is out of production and is being replaced by the Joint Services Lightweight Integrated Suit Technology (JSLIST) ensemble. DoD is replacing BDO war reserve inventories with JSLIST ensembles as the BDO shelf life expires. In 1999, DoD acquired approximately 260,000 JSLIST suits. Four manufacturing facilities, three of which are controlled by the National Industries for the Severely Handicapped (NISH), produce JSLIST suits. (As required by the Javits, Wagner, O'Day Act, the Department awarded NISH 169,000 JSLIST suits in 1999). Von Blucher GmbH, a German firm, owns the patent for the JSLIST suit liner fabric. Our North Atlantic Treaty Organization allies use the same suit liner technology for their chemical protective suits. Von Blucher recently opened a manufacturing facility, with limited capability, in Maine. Von Blucher expects to add machinery that will allow the Maine facility to perform all processes within the next year. DLA conducted an assessment to determine if current production capabilities are adequate to meet planned sustainment requirements.

The assessment concluded that Von Blucher has sufficient production capacity to meet planned post-conflict replenishment requirements, but would require four months to acquire the raw material needed to produce fabric liner in excess of peacetime requirements. Therefore, without a "readiness bubble" of fabric liner stored within the continental U.S., DoD would be unable to immediately surge and sustain production above peacetime levels. Quantified surge requirements will be evaluated and developed as the JSLIST suits replace BDOs in the war reserve inventory and the Services identify inventory shortfalls. Nevertheless, the Department expects that, in the event of a surge in requirements, all Services will request the latest suit technology, thus placing an extraordinary demand on JSLIST production capabilities. DoD likely could meet that demand only if there is liner fabric in place to surge manufacturing while fabric suppliers increase production.

DLA has awarded a series of liner fabric contracts to Von Blucher GmbH, through its wholly owned U.S. selling agent, Tex Shield. In February 1998, DLA exercised a \$2.43 million contract option for liner fabric. DLA now has a liner fabric reserve of 185,000 yards, enough to produce in excess of 56,000 JSLIST suits. The contract also provides for fabric storage, currently in Maine, in close proximity to two of the four manufacturing facilities. DLA is developing a mechanism to rotate the liner fabric reserves into JSLIST production pipelines, ensuring reserve fabric is used before shelf life expires. In 1999, DLA awarded a \$50,575 contract to store the existing fabric.

DLA originally anticipated that Von Blucher would have the Maine coating and lamination facility fully operational in 1999. Had that happened, DLA planned to purchase carbon beads and preposition them at the Maine facility to facilitate accelerated production. This would have been a more cost effective alternative than prepositioning fabric liner material and it also would have increased shelf life. DLA deferred a decision on this alternative until Von Blucher completes the facility, now scheduled for 2000. When Von Blucher completes its Maine facility, DLA will reassess the use of fabric liner components, instead of finished material, to support wartime surge.

DoD also is seeking substitute technologies that can be inserted into the JSLIST suit to alleviate any production capacity risks associated with the sole source liner fabric supplier. However, certification testing of promising technologies is not anticipated until mid-2000.

Chemical Protective Gloves Follow-on (November 1999)

Chemical protective gloves are an integral part of the chemical protective ensemble used to protect troops from chemical and biological weapons attack. This assessment reevaluated issues previously addressed in 1996, 1997, and 1998. It was designed to determine if essential industrial capabilities would be lost in the absence of peacetime DoD procurements. DLA concluded:

- These gloves are military-unique. Butyl rubber is the only known material capable of meeting all Service requirements for protection against chemical and biological agents. The butyl rubber solvent dipping process used to produce the gloves requires unique manufacturing processes and hazardous material recovery equipment. The specialized equipment needed, and requirements for special licenses from the Occupational Safety and Health Administration and the Environmental Protection Agency, discourage entry of new sources.
- The gloves have a shelf life of 15 years; extended from 5 years as the result of a shelf life extension program. Even with these extensions, the Department expects significant Service inventory attrition during the next 2-3 years.
- Two companies, North Safety Products and Guardian Manufacturing, have the equipment and licenses required to manufacture butyl chemical protective gloves. Under the terms of an IBMC, each is required to ensure it has sufficient production capacity to meet planned replenishment requirements. (Absent the IBMCs, peacetime production would provide insufficient incentive for the contractors to retain protective glove industrial capabilities. The IBMCs ensure the industrial capabilities are preserved; however, they do not sustain sufficient surge production capacity to overcome inventory shortfalls.)
- The Department had anticipated that the Joint Services Lightweight Integrated Suit Technology (JSLIST) Program would introduce a new generation glove in 1997. However, the new protective gloves did not meet testing requirements. Continuing the IBMCs ensures that DoD retains the ability to meet projected glove requirements until a new glove is proven satisfactory.
- DoD has begun a protective glove pre-planned product improvement program to develop and qualify gloves capable of meeting all chemical protective requirements. The first sample was delivered for testing in October 1997. Indications were that these gloves could be produced on the same production lines being sustained under the IBMC. However, the samples did not pass chemical testing. New tests are not expected until 2003; test results would not likely be available until at least one year later.

In May 1999, DLA awarded 1-year IBMC options totaling \$3.940 million to North Safety Products and Guardian Manufacturing. The IBMC contains one additional 1-year option with each company.

Sutures and Bandages (March 1999)

Sutures and bandages are used to close and protect cuts, incisions, and lacerations stemming from surgery or trauma. DoD's wartime requirements for these items present significant challenges. It is difficult to determine what types of sutures and bandages actually are being produced, stored, and sold to meet commercial demand. This lack of commercial manufacturer product line and production capability information hinders DoD's ability to prepare for projected operational scenarios.

In 1998, DLA assessed sutures to determine if there were sufficient industrial capabilities to meet wartime demand. On August 27, 1998, DLA awarded Johnson and Johnson's Ethicon Division a \$2 million Corporate Exigency Contract (CEC) establishing a long-term partnership to: (1) obtain manufacturing data regarding products currently in production; and (2) provide sutures to meet projected sustainment requirements. In 1999, DLA reassessed suture requirements and also evaluated the industrial capabilities required to meet projected bandage requirements. The evaluation and assessment for sutures and bandages concluded:

- There are several manufacturers of both bandages and sutures. Items are supplied in various sizes, types, and styles, which make standardization difficult.
- Medical/surgical supply manufacturers do not have enough material on hand to support the DoD's projected time-phased contingency sustainment requirements.
- Bandages and sutures are an ever-changing commodity; a style or size used today may become obsolete over the next 6 months.
- The CEC concept is an innovative and valuable industrial preparedness measure that combines aspects of Vendor Managed Inventory, stock rotation, and commercial asset visibility.

In 1999, DLA awarded CEC contracts totaling \$4.28 million to increase its coverage for sutures and provide initial production surge capabilities for bandages.

Gelatin Sponges (February 1999)

Gelatin sponges are absorbable sponges that are impregnated with Gelfoam®, a gelatinous material. When the sponge is applied to an open wound, the gelatin paste interacts with the oozing blood to form a protective barrier that hastens the clotting process. DoD plans to use the sponges for the majority of expected wartime casualties. Projected wartime demand exceeds peacetime demand significantly. This assessment was designed to determine how to ensure that DoD would have access to gelatin sponges in sufficient quantities to meet projected wartime requirements. The assessment concluded:

- The technology involved in the production of gelatin sponges precludes rapid production increases.
- The gap between the ability of the current manufacturers and distributors to supply gelatin sponges and the Services' requirements is projected to increase precipitously after day 45 of a conflict.
- New manufacturers are expected to enter the market in the future.
- A Vendor Managed Inventory (VMI) arrangement would dramatically improve the availability of sponges to meet wartime requirements.

DLA added gelatin sponges, at a cost of \$214,000, to a VMI contract for pharmaceuticals originally awarded in 1997. The original VMI contract was for one year, with nine option years. Under this VMI contract, healthcare industry distributors agreed to provide inventory management and guaranteed availability for shelf-life readiness items. DLA does not actually take delivery of materiel until needed. The inventory upon which DLA would draw, if necessary, is rotated with the distributor's commercial sales. In the event of an emergency, DLA would draw on that inventory until the industrial base could increase production to meet DoD's requirements.

Patient Care Items (May 1999)

In 1999, DLA completed an industrial assessment of four patient care items. Urethral Catheterization Kits are used during surgical procedures to analyze bladder contents. Blood Collecting-Dispensing Bags and Donor Sets are used to collect blood from, or dispense blood to, appropriate personnel. Sterilization Indicator Liquids are utilized to evaluate sterilizers for effectiveness. Blood Testing Kits are used to perform blood and platelet counts on patients. Projected requirements for these items increase significantly immediately after a conflict begins. They are required to save or sustain life or limb and to prevent or reduce impairment or disease. Additionally, all have a shelf life ranging from 15 - 24 months. The assessment concluded:

- The gap between the ability of the current manufacturers and distributors to supply these patient care items and the Services' requirements is projected to increase precipitously after the first 20 days and does not significantly improve until 150 days after a conflict begins.
- Even with dedicated production capabilities, there is insufficient capacity to meet the Services' requirements.
- Due to shelf-life considerations, manufacturers and distributors can not maintain significant stockpiles of materiel.
- A VMI arrangement would increase the availability of these critical items, significantly.

In August 1999, DLA added these items to an existing VMI Medical Surgical contract at an additional cost of \$1.4 million. Materiel is stored at the vendor's facility and rotated with its commercial sales. This funding level satisfies the demands of early-deploying units and provides for increased supply levels during sustainment. Fresh materiel is available to the Services when required. The Services and DLA can update requirements to resolve surge and sustainment issues, when necessary.

KC-135 Accumulator (Feb 1999)

The KC-135 accumulator is a consumable item used in the aircraft air refueling boom system. It is critical to the mission of the KC-135R aircraft. DLA conducted this assessment to determine if adequate industrial capability exists to support projected wartime requirements. The assessment concluded:

- The accumulator is a sole source, proprietary, product of Senior Flexonics, Inc., Metal Bellows Division. No other source produces an equivalent item, or has access to the item drawing required to produce the current accumulator or its major subassemblies.
- The accumulator has three major subassemblies (Accumulator Housing, Bellows assembly, and Plug assembly). Each subassembly requires long lead material, high tolerance machining processes, serial manufacturing processes, special machining jigs, and special handling.
- Production lead-times are too long to rely only on accelerated production to meet projected wartime requirements.
- Stocking raw materials would not reduce production lead-times significantly; the value added to component or sub-components would be minimal.
- Pre-positioning critical long lead-time subassemblies will reduce production lead-time such that wartime demand can be met. The three subassemblies can be inspected, packaged, and stored without jeopardizing component investments or end item integrity.

DLA awarded a \$279,000 contract to Senior Flexonics, Inc. to produce and store the three subassemblies in sufficient quantities to meet projected wartime requirements. The contractor will buy the material, build the subassemblies, and store the completed subassemblies at its facility.

Tray Pack Ration Readiness Investment Follow-on (January 1999)

Tray pack rations are a member of the family of DoD field combat rations. They are used to sustain groups of military personnel in highly mobile field situations. The component items are thermally processed, shelf-stable foods, packaged in hermetically sealed, table-size metal containers. DoD contingency requirements for tray pack rations greatly exceed peacetime requirements. In this assessment, DLA reevaluated issues previously addressed in May 1996 and

January 1998. DLA compared current tray pack ration industrial capabilities to those required to meet contingency requirements. The reevaluation concluded:

- Peacetime production quantities are insufficient to maintain continuous production of tray pack can bodies and lids. Prime and subtier suppliers produce only periodically for peacetime requirements.
- The availability of tray pack cans and lids in the early stages of a contingency is one of the limiting factors in increasing production to meet contingency requirements.
- The commercial food industry is moving away from metal trays and toward polymeric trays for refrigerated food service items. The Services intend to leverage commercial technology by transitioning from metal can trays to the polymeric tray technology.

The Services will convert to the new polymeric tray during 2000, for both peacetime and wartime. In 1999, at a cost of \$90,000, DLA upgraded its government-owned food processing equipment (retorts) to reduce lead-times and increase output of both metal and polymeric cans. Additionally, DLA awarded a \$110,000 contract to purchase racks to retrofit reserve government-furnished retorts to accommodate the polymeric tray. The new racks will hold the less rigid polymeric trays in the proper position within the retorts, ensuring even heat transfer. In order to meet projected tray pack ration wartime requirements, DLA has pre-stocked metal tray pack cans and lids and improve selected production processes. These actions increased tray pack production capacity sufficiently to meet those projected wartime requirements for polymeric trays identified during the assessment.

Tents Follow-on (November 1999)

Tents and tent liners are critical when mobilizing troops. During fiscal years 1997 and 1998, DoD's peacetime requirements for new tent production diminished to about one-third of previous levels. The Services drew down inventories and focused on developing next generation products. DoD suppliers reacted predictably. One firm reduced its workforce, dismissed all of its government tentage-related employees and retreated to another business area; a second closed completely. The seven firms remaining depend solely on military business. Several of these firms may be forced to exit the business. DoD needs to be able to draw on the production capacities of all of the remaining firms to meet projected surge requirements. These capacities, if lost, would take at least a year to reconstitute. DLA concluded that, absent intervention, the survival of several of the remaining firms was in jeopardy.

In 1998, DLA developed an acquisition strategy that would support six of the seven companies. DLA ensured the viability of the six firms by apportioning projected peacetime sales among the companies. In addition, DLA awarded a \$468,000 contract to the seventh company designed to assure it retained the level of workload required to sustain needed production capabilities.

In 1999, DLA reevaluated the issues and concluded that it should continue to sustain the production capabilities resident in the seventh firm. Consequently, DLA issued that firm a follow-on contract of \$468,000.

5. Related Activities

5.1 Industrial Capabilities Improvement Activities

In addition to performing industrial capabilities analyses, several DoD programs and/or activities specifically seek to develop or improve industrial capabilities.

DoD Manufacturing Technology Program

DoD's Manufacturing Technology (ManTech) Program develops new and improved manufacturing processes to facilitate more affordable production of DoD weapon systems and components. The Program addresses process technology issues from the systems development phase through transition to production and into sustainment. ManTech investments target defense-essential needs that industry would not otherwise pursue alone in a timely manner. ManTech improvements generally translate into cost avoidance or cycle time reductions. However, investments also focus on developing "new" capabilities that actually may result in a more expensive component, but will provide dividends in system performance or life cycle cost that far outweigh the initial cost. The DoD ManTech Program is structured around two major thrust areas:

- *Processing and Fabrication* activities develop affordable processes for metals, composites, and electronics by improving factory floor and repair and maintenance facility (depots, logistics centers, and shipyards) processes.
- *Advanced Manufacturing Enterprise* activities accelerate implementation of world-class industrial practices, advanced design, and information systems that support weapon system development, production and sustainment.

In addition to the two thrust areas, the ManTech Program also includes two special emphasis areas:

- *Energetics/Munitions* projects focus on improving processes associated with propellants, explosives, pyrotechnics, reactive chemicals, and conventional munitions.
- *Sustainment* projects coordinate common DoD opportunities to increase the reliability and reduce the cost of repair processes for aging systems.

In response to the requirements of 10 U.S.C. section 2525(e), the Department issues an annual Five-year Plan for the ManTech Program⁷ in February of each fiscal year. The Plan:

⁷ The current Plan is available on the Internet (<http://mantech.iitri.org/pubs/pubs.shtml>).

- Describes the ManTech Program's goals, priorities, and investment strategy.
- Presents Military Department and Defense Logistics Agency funding for fiscal year 2000, and planned funding for fiscal years 2001 through 2005.
- Includes a description of all projects completed in the past three years and the status of implementation.
- Assesses the extent of cost sharing with commercial enterprises, defense program offices, other federal agencies, institutions of higher learning, and other sources.
- Summarizes program measures of effectiveness and the results of internal and independent reviews.
- Provides examples of success stories and achievements.

Title III of the Defense Production Act

The Defense Production Act (DPA) (50 U.S.C. App. 2061 *et seq.*) is the primary legislation designed to ensure that the industrial resources and critical technology items essential for national defense are available when needed. Title III of the DPA provides a vehicle to establish, modernize, or expand domestic production capability and capacity for technology items, components, and industrial resources that are essential for national defense provided: (1) no domestic capacity exists or (2) the domestic capacity that does exist is insufficient to meet defense needs. Under the authorities of Title III, DoD can provide domestic firms with a variety of financial incentives to reduce the risks associated with establishing the needed capacity. These incentives include purchases or purchase commitments, loans and loan guarantees, and the purchase or lease of advanced manufacturing equipment which can be installed in government or privately owned facilities. DoD uses purchases and purchase commitments most frequently.

The Department organizes and executes the Title III program as a DoD-wide program, generally focusing on materials and components that can be used in a broad spectrum of defense systems. The Office of the Secretary of Defense provides top-level management, direction, and oversight. The Air Force, acting as the Executive Agent for this program, structures and executes approved and funded projects for the Department. In 1999, the Department initiated two new Title III projects, began development of two others, and completed two projects.

Silicon Carbide (SiC) Substrates

The objective of this project is to establish viable, world-class, domestic sources of high-quality silicon carbide semiconductor substrates. The project will increase material availability, improve quality, reduce cost, and accelerate insertion of SiC technology into defense applications. Furthermore, it will facilitate transition to full scale manufacturing by establishing the capability to produce 75mm diameter SiC substrates for device fabrication. The value of the project, including industry cost sharing, is \$17 million; it will run through 2002.

Silicon-on-Insulator (SOI) Wafers

SOI substrates can significantly improve the performance of low power and/or radiation-tolerant integrated circuits used in defense systems. This project will establish domestic sources for SOI wafers (up to eight inches in diameter) that have emerged from research and development but which require lower-cost, higher-volume production capabilities before they can be inserted affordably into DoD systems. The project is designed to provide sufficient incentives to create a domestic SOI wafer production capacity of 1.4 million square inches per year. The total value of this three-year effort, including industry cost sharing, is \$9.3 million.

Microwave Power Tubes

Microwave power tubes generate and amplify microwave energy in radar systems, electronic warfare systems, and telecommunications systems where high frequency and high power are required. This project will facilitate DoD's assured access to affordable microwave power tubes by providing incentives to encourage lower tier microwave power tube suppliers to make consistent, quality-driven improvements. DoD's goal is to transition advanced manufacturing processes to the lowest-tier suppliers of components and materials; thus improving overall quality and lead times and driving down the production and life cycle costs of microwave power tubes for the DoD. The Department will use Title III authorities to facilitate supplier process improvements, qualify alternate materials and processes, and share integration and investments both horizontally across the supplier base and vertically between suppliers and microwave power tube manufacturers. Congress appropriated \$3.0 million in the Fiscal Year 2000 Defense Appropriation Act (P.L. 106-79) specifically for this Title III project.

Laser Protective Eyewear

This project will establish a highly responsive, affordable production capacity for thin film dielectric coatings on polycarbonate substrates, the basic component in laser protective eyewear. The widespread proliferation of lasers in military operations is posing an increasingly significant threat of eye injury to military personnel. The project will assure that domestic producers are available to supply these devices in sufficient quantities and at affordable prices to meet defense needs. The Title III project will use purchase and purchase commitment incentives to assist in establishing a viable, domestic capacity on a high-volume, commercial ("dual produce") production line for laser protective eyewear for military and commercial applications. This project also will accelerate the implementation of compatible interference filter technologies, such as dry process holographic filters and/or rugate filters, to protect against a broader range of laser threats. Projected Title III funding is \$5 million, plus cost sharing from the project contractor(s). The project is expected to run approximately 36 months.

Small Flat Panel Displays

DoD qualified a night vision heads-up-display system incorporating small format active matrix electroluminescent flat panel displays for Special Operations Forces applications, and helped establish an efficient domestic production base capable of producing affordable small

format flat panel displays for both military and commercial applications. The project, which was very successful, was begun in April 1997 and completed in February 1999.

The benefits accruing from this project are significant. Operational capabilities have been increased. Unit system cost is \$7,000 less than previous unit system cost. Reliability has been increased by more than 20 times (from 450 hours to over 10,000 hours). The size and weight of the displays have been reduced by more than 70 percent. Commercial design practices and components ensure the system will be supportable in the future. The improved capability to see in the dark and to have access to critical flight information quickly will provide the Services with an enormous advantage during military operations.

High Purity Float Zone (HPFZ) Silicon

This project, initiated in November 1993, was designed to use Title III incentives to establish a self-sustaining domestic capability to competitively produce world-class HPFZ silicon products essential for many DoD and commercial applications. Prior to completing this Title III project, the DoD was dependent on foreign sources for all HPFZ silicon used in defense systems.

HPFZ silicon is widely used by the U.S. Army, Navy, and Air Force for critical high power electronic devices used to control radar systems, advanced aircraft, tanks, submarines, and other weapon systems. Defense applications for HPFZ silicon center around three specific applications: high power switching devices, infrared (IR) detectors, and vidicons. High power switching devices enable the replacement of large electromechanical switches with smaller, faster, less expensive devices with greatly enhanced reliability. Defense applications for high power switching devices include radar/sonar systems, missile systems, ships/submarines, and armored vehicles. IR detectors are employed in laser seeking and heat seeking weapons systems. Vidicons convert infrared light to visible radiation for night vision applications. At its conclusion in April 1999, this project had established a full-scale, affordable, domestic manufacturing capability with the ability to provide an assured source of high quality HPFZ silicon for defense and commercial needs.

DoD Technology Transfer Program

The Department created the Office of Technology Transition within the Office of the Secretary of Defense in response to 10 U.S.C. 2515, which called for DoD to establish a focal point to ensure that technology developed for national security purposes is made available to the private sector in the United States. The Office of Technology Transition has created a broad program to help the Nation achieve an improved return on its national security technology investment and, concurrently, improve the Nation's industrial competitiveness.

In May 1999, the Department issued DoD Directive 5535.3 and DoD Instruction 5535.8, both entitled *DoD Domestic Technology Transfer Program*, to institutionalize the program and ensure technology transfer becomes an integral element in the pursuit of our national security mission. Because technology transfer activities support a strong industrial base, they "must have a high priority role in all DoD acquisition programs and are recognized as a key activity of the

DoD laboratories and all other DoD activities that may make use of or contribute to domestic technology transfer."⁸ These policy documents also recognize that technology transfer, from DoD and to DoD, is essential if the Department is to have access to the best technology for its systems, wherever that technology may be found.

The Technology Transfer Program operates in a decentralized manner within DoD. The Military Departments are recognized as separate agencies for program implementation and have over 100 Offices of Research and Technology Applications (ORTAs) and other technology transfer focal points. These personnel communicate within DoD activities and with potential and existing partners in the private sector. The ORTAs and legal staff participate in both annual DoD Technology Transfer Integrated Planning Team workshops and the Federal Laboratory Consortium for Technology Transfer. The Department also has established a website to enhance communication with the private sector, advertise those federally developed technologies believed to have potential commercial application(s), and highlight success.⁹

The Department has established mechanisms to facilitate DoD Technology Transfer Program success:

- The Picatinny Innovation Center within the Army's Armament Research, Development, and Engineering Center is a business incubator designed to help start-up companies create employment opportunities and act as a technology transfer mechanism to share DoD resources with the private sector.
- DoD has entered into Patent License Agreements to allow the private sector to produce items with patented technology developed in DoD laboratories. Patenting and then licensing DoD technology is an effective method to transfer technology into both defense systems and commercial items.
- Cooperative Research and Development Agreements (CRADAs) are a key tool to transfer technology to the private sector. For example, they can be used to allow DoD employees to work side-by-side with their private sector counterpart to develop technologies needed for both military and commercial applications. As of October 14, 1999, DoD laboratories were participating in 1638 CRADAs with the private sector.
- DoD has four active Partnership Intermediary Agreements (PIAs) supporting efforts to transfer technology to the private sector. The most recent PIA, with Montana State University, was signed in July 1999. The University is managing the TechLink Center in Bozeman, MT to help identify partners to develop technology, licensees for DoD technologies, and technologies of potential use to DoD.

North American Technology and Industrial Base Organization

The Department co-chairs the North American Technology and Industrial Base Organization (NATIBO). NATIBO is chartered to promote a cost effective, healthy technology

⁸ DoD Directive 5535.3.

⁹ (<http://www.dtic.mil/techtransit/>).

and industrial base that is responsive to the national and economic security needs of the United States and Canada. Its primary purpose is to identify and analyze key technology and industrial sectors that are critical to defense, assess the viability of these sectors, identify issues and barriers related to sector viability, and develop strategies to enhance and sustain the health of the marketplace. NATIBO maintains a website¹⁰ describing the organization, its accomplishments, and its ongoing activities. The website also contains copies of recent NATIBO industry assessments.

Army Horizontal Technology Integration Program

The Army's Horizontal Technology Integration (HTI) Program is designed to apply common technologies across the force to increase mission effectiveness by simultaneously improving performance, encouraging product standardization, and increasing interoperability. HTI reduces overall costs by fostering common technology development and permitting the "bundling" of procurements across weapons platforms to take advantage of common products. Additionally, it facilitates the rapid fielding of high payoff technologies. The Army has established a website¹¹ to explain and guide program implementation.

Army Aviation and Missile Command

The Army Aviation and Missile Command has undertaken several related projects to improve industrial and technological capabilities needed for its missiles programs.

Ultra High Modulus Polyacrylonitrile Carbon Fibers

Polyacrylonitrile (PAN) carbon fibers are used extensively in military composite structures applications where signature reduction, light weight, high tensile strength and high tensile modulus (stiffness) are important. The Army has awarded a managed cost-sharing contract to Hexcel Corporation (\$4.16 million from Hexcel and \$2.08 million from the Army) to improve U.S. production capabilities for a family of ultra high modulus PAN-based carbon fibers for structurally demanding (specifically, missile kill vehicle structures) applications.

Plastic Encapsulated Microcircuits

The Army wants to leverage the robust commercial market in plastic encapsulated microcircuits (PEMs) for its missile applications. The principal risk in utilizing PEMs for missile applications is uncertain reliability after long-term, non-operating storage. The Army is developing improved coating processes for PEMs manufacture and has established an integrated process team, with industry, to identify risks, share information, and evaluate potential risk mitigation methodologies.

¹⁰ (<http://www.dtic.mil/natibo/>)

¹¹ (http://www.sarda.army.mil/sard-zs/hti/hti_docs.html)

Affordable Multiple Missile Manufacturing

Industry consolidation among missile manufacturers and suppliers has raised concerns about: (1) quality and reliability as people and processes transition to new facilities; (2) reduced competition in the supplier base; and (3) retention of personnel skilled in program-unique software and missile-unique technologies. The Army, Navy, Air Force, Defense Advanced Research Projects Agency, and industry representatives have established pilot efforts to demonstrate rate insensitive missile manufacturing methodologies to address these concerns. The team is combining flexible manufacturing concepts, commercial management methods, and state-of-the-art technology to improve industrial and technological capabilities -- and reduce program costs.

5.2 Commercial Technology Insertion

The Department also identifies, adapts, and leverages predominantly commercial and dual use capabilities and products.

Commercial Operations and Support Savings Initiative

Extending the service life of a military system can cause operations and support (O&S) costs to increase. In addition, military-specific components contained in many legacy systems have become obsolete and hard to get at any price. The Commercial Operations and Support Savings Initiative (COSSI) program adapts commercial technologies for use in legacy military systems to reduce O&S costs. COSSI uses an acquisition method that mirrors commercial market practices. It encourages non-traditional suppliers to provide DoD with innovative products and technologies. DoD and the contractor share COSSI project costs. Costs sharing and partnering with industry allow DoD to leverage a commercial firm's technology investments to reduce costs and improve the performance of fielded defense systems. At least 25 percent of the costs associated with the non-recurring engineering, testing, and qualification needed to adapt a commercial technology for use in a military system are borne by the contractor.

DoD funded COSSI projects totaling \$56 million in fiscal year 1999 and plans to fund projects totaling \$85 million in fiscal year 2000. COSSI projects initiated since 1997 have the potential to reduce O&S costs by more than \$4 billion over the next 12 years. For example, one COSSI project (for H-53 and H-60 helicopters) leverages an integrated mechanical diagnostic, health and usage management system developed for civil air ambulances and helicopters servicing off shore oil platforms. Currently, DoD helicopter diagnostics are done manually. The process is labor intensive, inexact, and often leads to unnecessary removals. The new system will automatically collect and analyze in-flight data. DoD will benefit from better maintenance decisions, lower maintenance costs, and early detection of parts failures, including potentially catastrophic failures. Because less time will be required for maintenance, the costs of helicopter operations and maintenance also will be reduced substantially.

Dual Use Science & Technology Program

DoD initiated the Dual Use Science & Technology (DU S&T) Program in fiscal year 1997 to leverage limited DoD S&T funds by partnering with industry and to increase the insertion of dual use technologies into defense systems. The Program defines a dual use technology as a technology that has both military utility and sufficient commercial potential to support a viable industrial base. Increasing the use of dual use technologies permits DoD to take advantage of the same competitive pressures and market-driven efficiencies that have led to accelerated development and savings in the commercial sector.

The Program jointly funds research projects with industry that develop dual use technology solutions for DoD problems. DoD funded DU S&T projects totaling \$29.6 million in fiscal year 1999 and plans to fund projects totaling \$30 million in fiscal year 2000. Since the Program began in fiscal year 1997, DoD and industry have invested over \$700 million in over 200 projects to develop dual use technologies. More than half of this funding has come from industry. The Services issue a joint DU S&T solicitation in January of each year requesting industry proposals in specific topic areas:

- Affordable Sensor Technology
- Weapon System Sustainment
- Distributed Mission Training
- Advanced Propulsion, Power, and Fuel Efficiency
- Information and Communications Technology
- Medical and Bioengineering Technologies
- Advanced Materials and Manufacturing
- Environmental Technologies

Joint development of technology with industry provides the Department significant benefits; it:

- Leverages DoD S&T funds by partnering with industry to meet defense needs. During the first three years of the Program, industry participants have invested over \$378 million to develop technologies to meet future defense needs.
- Accesses commercial technologies. Over 70 commercial firms have participated in the Program. Many previously had done little or no business with the DoD.

- Incorporates defense considerations into commercial technologies. Defense funding ensures that technologies or components developed within the Program have incorporated unique defense requirements into the design.
- Reduces acquisition and logistics costs. The increased use of commercial technologies provides the Department with the economies of scale of the commercial market and the worldwide logistics support often available from commercial companies.

Projects initiated in fiscal year 1997 and 1998 are beginning to bear fruit. A few examples follow.

Active Braking System for Medium Duty Wheeled Vehicles

Continental Teves has developed an Anti-lock Braking System (ABS) for the Army's High Mobility Multipurpose Wheeled Vehicle (HMMWV) and medium size commercial truck. The braking system will go into production in 2001 with projected commercial sales of at least 80,000 units per year. Because Continental Teves considered the DoD's special requirements during design, its ABS will meet HMMWV requirements with no major modifications.

Besides the obvious benefits of improved braking and safety, DoD also will have access to a commercial product that meets a military requirement at a reduced cost. The ABS developed under this program will be produced on the same line as Continental's commercial ABS and sold to the Army at approximately \$500 per unit. This represents savings of \$1,700 per unit based on earlier estimates of \$2,200 per unit for an ABS developed exclusively for the HMMWV. Savings on retrofits for existing HMMWVs and new production may reach \$100 million. In addition, the Army will have access to worldwide logistics support from Continental Teves.

Affordable Antenna for Weapon System Delivery & Cellular Communications

Raytheon Systems Company is developing an antenna for weapon system delivery that also has commercial cellular communications applications. The cost of the new antenna will be approximately 10 percent of the cost of the antenna currently used for weapon system delivery. As a result of this project, DoD will have access to an affordable airborne antenna that is as capable as current antennas, and more reliable. Over 2,000 commercial versions of the antenna already have been sold for use in telecommunications applications.

Optical Character Recognition

Applications Technology Incorporated, a small commercial business, is developing a highly accurate optical character recognition (OCR) system for Arabic and Persian script. The new OCR system will replace the inadequate systems currently being used. DoD already has transitioned the technology to the Counter Intelligence/Human Intelligence Advanced Concept Technology Demonstration project. Applications Technology has committed funds to develop commercial applications for the technology.

The product will provide the Army an improved capability to collect and analyze intelligence from foreign language documents in low-quality formats, allowing troops in the field to react more quickly to intelligence information. The commercial market for multilingual OCR systems is growing, with special interest in documents from the Arabic world, where electronically represented text is relatively recent and original documents must be scanned and converted.

Thermal Sprayed Nanostructural Coatings

Nanodyne Incorporated, a small commercial business, is leading a consortium developing highly wear and corrosion resistant nanostructured coatings for use on ships, aircraft and land vehicles. The coatings will reduce life-cycle costs and better comply with environmental regulations. This technology will allow DoD to repair components currently being replaced, extend the service life of wear damaged components by a factor of two to five, and eliminate the need for chrome plating for a wide variety of applications. The coatings are a leading candidate for a Secretary of the Navy initiative to fast-track technology into the fleet.

Nanostructured coatings provide similar benefits in commercial industry. Potential commercial applications include automobiles (clutch plates, fuel injectors, piston rings, cylinder walls, and valve seats,) aircraft gas turbine engines, machine tools, and mining equipment. Industry is making additional investments to commercialize the technology.

Maritime Technology Advanced Shipbuilding Enterprise Program

The Navy's Maritime Technology (MARITECH) Advanced Shipbuilding Enterprise (ASE) program supports the industry-led National Shipbuilding Research Program (NSRP). The MARITECH ASE program leverages NSRP cost-shared collaborative research and development projects to reduce costs and cycle times for Navy warships and to promote U.S. shipbuilding international competitiveness.

MARITECH ASE is led by a collaboration of several U.S. shipyards using the DoD *Other Transactions* acquisition method. The chief executive officers of the nine major U.S. shipyards signed a joint industry-wide Strategic Investment Plan that articulates the process and technology challenges facing the U.S. shipbuilding and repair industry and also the actions required to overcome these challenges. The plan calls for a \$400 million cost-shared investment over five years (government and industry each funding \$40 million/year).

The industry-led NSRP combines the resources of industry, academia and multiple government agencies (the Departments of Defense, Transportation, Commerce, Energy, Labor, Health and Human Services, and the Environmental Protection Agency) to leverage other shipbuilding R&D investments. R&D opportunities are open to the entire industry and results are shared openly. In 1999:

- The Navy selected thirteen shipbuilding R&D projects from the NSRP strategic plan (each of one to three years' duration) for MARITECH ASE funding. Industry funded 67 percent of the cost of these projects (required industry cost share is 50 percent).

- The NSRP commissioned a global shipbuilding benchmarking effort of U.S. and international (Asian and European) world class shipyards, to be complete in early 2000. The benchmarks will be used to quantify the cost and cycle time performance gaps between U.S. and foreign shipyards, and to help prioritize future R&D projects to close these gaps.

5.3 Executive Agents and Working Groups

DoD sometimes has limited visibility into industrial issues associated with custom components (non-commercial items or subsystems) used in multiple defense applications. Generally, development and procurement of such components are decentralized. Major system contractors and subcontractors, program offices within each Military Service and the Defense Logistics Agency, and even civilian agencies, all can play significant roles. In such cases, DoD can establish corporate mechanisms to better monitor the industrial and technological infrastructure providing these components and coordinate DoD's own activities.

Microwave Power Tubes

Microwave power tubes are used to generate and amplify microwave energy -- a form of electromagnetic radiation. DoD uses microwave power tubes such as klystrons, traveling wave tubes, and crossed field amplifiers in land, sea, air, and space applications. More than 270 different types of DoD radar, electronic warfare, and telecommunications systems employ over 180,000 microwave power tubes with a total value of \$2.8 billion. The number of operational microwave power tubes in DoD applications will continue to increase over the next five years as DoD deploys new and upgraded weapon systems. DoD will need to be able to access affordable, high performance, microwave tubes for the foreseeable future.

The Microwave Tube Division of the Electronic Industries Alliance reported 1998 sales (the last year for which data is available) of \$256 million, 85 percent of which were for DoD applications. Thus, the U.S. microwave power tube industry market is dependent on DoD sales.

In 1997, DoD designated the Navy as its Executive Agent to: (1) identify and maintain consolidated DoD microwave power tube acquisition requirements and research and development plans; (2) monitor the major domestic microwave power tube manufacturers and key component and material suppliers; and (3) facilitate coordination among the Services and other U.S. government agencies that use microwave tubes.

The Executive Agent, in cooperation with the other Military Departments, has:

- Sponsored a workshop for 200 industry and government personnel to discuss acquisition microwave power tube issues from both the operational and acquisition perspectives.
- As part of the Tri-Service Manufacturing Technology program, advanced the cost-effective manufacture of millimeter wave products for radar applications such as missile seekers and foliage penetration.

- Continued the Office of Naval Research/Naval Research Laboratory initiative in category 6.2 research and development investment. The investments focus on developing innovative device concepts, advanced computer models and simulations, and enhanced material science technologies, both for advanced system concepts and for upgrades to deployed DoD systems.
- Initiated efforts to integrate the Air Force Research Laboratory's Advanced Research Project in Vacuum Electronics with other Science and Technology programs. A consortium of six universities is conducting advanced research in vacuum electronics, and yielding graduate engineers with advanced degrees and excellent design experience when they enter the work force.

The Executive Agent, on behalf of the DoD, is monitoring and/or addressing several areas of concern:

- Microwave power tube manufacturers have indicated that their most pressing concern in supplying affordable microwave power tubes over the long term is their ability to access a reliable supply of various critical materials (beryllium-based ceramics, helix tape, filament wire, and cathodes). DoD identified several microwave power tube supplier issues in 1997 (summarized in the February 1997 *Annual Industrial Capabilities Report to Congress*) and has been working to mitigate risks associated with these issues.
 - Of immediate concern is the closure of the industry's sole supplier of silicon carbide-loaded beryllium oxide ceramics. The Department is working with industry representatives to develop an alternate source to minimize near-term production gaps and operational impacts. Over the longer term, DoD is taking steps to eliminate requirements for hazardous materials in microwave power tube applications. DoD has begun two Small Business Innovation Research projects to develop alternatives to hazardous beryllium-based lossy ceramic.
 - Congress appropriated \$3 million in the Fiscal year 2000 Defense Appropriations Act (P.L. 106-79) to execute a Defense Production Act Title III project for microwave power tubes. The Department is developing the project.
- The 1997 Industrial Base study recommended that the Department's microwave power tube research and development investments be maintained at about \$18 million per year. Current Navy 6.2 funding (the only such finding in the DoD) is limited to \$10 million per year. This shortfall is impacting the availability of emerging products for use in new weapon systems. The Executive Agent is evaluating strategies to address this shortcoming.
- U.S. microwave power tube manufacturers have significant underutilized capacity. The problem is exacerbated by dramatic improvements in microwave tube operating life in the DoD systems that reduces DoD demand. The Executive Agent and industry

representatives are monitoring this concern and seeking mechanisms that would result in more cost-effective industrial facility workloads.

Radiation Hardened Microelectronics

Radiation *hardened* microelectronics are designed to withstand the deleterious effects of extremely high radiation levels that might occur as the result of a nuclear weapon burst. Conversely, radiation *tolerant* microelectronics are able to withstand the effects of naturally occurring radiation such as that found in space but would fail or malfunction if subjected to nuclear weapon burst radiation levels. DoD satellites and missiles are required to function in more severe radiation rate and dose level environments than commercial satellites and launch vehicles. In 1996, the Department conducted an assessment to determine if there are and will be sufficient industrial capabilities -- technology, engineering, manufacturing, and test -- to meet projected DoD radiation hardened microcircuit requirements. The results of the assessment were summarized in the February 1997 *Annual Industrial Capabilities Report to Congress*.

In May 1997, the Under Secretary of Defense (Acquisition and Technology) formally directed that DoD:

- Implement a radiation hardened microcircuit research and development investment strategy (at between \$60 million and \$70 million, annually) to focus required technology and new product development activities.
- Establish a corporate management approach to oversee implementation.
- Explore a graduate initiative to bolster core expertise within government and industry.

In June 1999, the Department established the Radiation Hardened Electronics Oversight Council (RHOC) to ensure the continued capability and availability of radiation hardened electronics to meet U.S. security needs. Working groups monitor both production capabilities and the industry's ability to advance technology. The current environment can be characterized as unsettled.

- Two key suppliers of digital radiation hardened microcircuits (Honeywell and Lockheed Martin) to meet DoD's unique needs have experienced setbacks.
 - Honeywell installed new capital equipment to produce 0.35-micron devices, but delays in DoD and commercial space programs have reduced demand to the point that investments to advance their facility to the next generation devices have been deferred. In October 1999, Honeywell announced a second round of layoffs, in which it will reduce its staff by 145 employees by November 1999. This will bring total staff reductions to 37 percent for 1999.
 - Also because of insufficient demand, Lockheed Martin decided not to follow through with plans to purchase capital equipment to manufacture advanced microelectronics

(0.25- and 0.18-micron) devices. In October 1999, Lockheed Martin announced it planned to divest its radiation hardened microelectronics manufacturing facility.

- In July 1999, Raytheon (formerly Hughes) announced it was closing its radiation hardened microelectronics production facility, effectively eliminating DoD's major source of the radiation hardened cryogenic microelectronics needed for focal plane array applications. This position reversed that expressed to the 1996 Radiation Hardened Microelectronics Integrated Process Team in which Hughes representatives indicated a desire to enter the open market as a third dedicated supplier of DoD's strategic level radiation hardened parts. Defense Program Offices are devising a strategy to overcome this problem.
- In September 1999, a working group confirmed that the technology gap between the performance of radiation hardened microcircuits and that of commercial state-of-the-art devices continues to grow even though future DoD systems increasingly will utilize advanced radiation hardened electronics. The Department has developed a consolidated technology roadmap to meet DoD's future system needs for radiation hardened microelectronics, but programmed Science and Technology investments and Program Office research and development investments through fiscal year 2005 are insufficient to meet those needs. Working groups are investigating mechanisms to secure funding for the roadmap.

DoD also is addressing the issue of radiation *tolerant* devices by undertaking two initiatives dealing with production of radiation tolerant materials and devices for use in both military and commercial applications.

- A Defense Production Act, Title III project (see *Silicon-on-Insulator Wafers* in Section 5.1), seeks to establish a long-term, viable domestic manufacturing capability for large diameter, thick and thin, silicon-on-insulator wafers. The program's goal is to satisfy military and commercial silicon-on-insulator wafer requirements for radiation hardened devices.
- A Dual Use Science and Technology Program project has been designed to develop a large volume commercial electronics fabrication line capable of producing radiation tolerant parts, at a significantly reduced cost, on the same production line used for conventional electronic components. However, DoD efforts were set back when the National Semiconductor plant working with DoD was sold. DoD will continue the work with National's other plant, in Maine. If this effort is successful it will lead to microelectronic parts that can withstand a total radiation dose level of 100,000 rads. However, such parts would not be able to withstand the nuclear weapon burst radiation level requirements that DoD's strategic space systems must meet.

Flat Panel Displays

Flat panel displays provide enhanced performance and reliability over cathode ray tube displays. They are used increasingly in a variety of DoD applications, from head mounted

devices for individual soldiers, to tactical system cockpits, to wall sized displays for command and control systems. Flat panel displays provide a critical technology to the warfighter. Despite considerable DoD investment, DoD programs still need improved assurance of affordable access to flat panel display technology. Several contractors specializing in DoD applications have ceased operations in recent years and the sole remaining defense custom flat panel display glass producer is experiencing financial difficulties. Resolving the short-term disruption of flat panel display deliveries likely will not resolve long-term problems. In the past, DoD did little to standardize its flat panel display requirements; instead it often purchased systems containing designs unique to that end item. This approach has led to high costs now, projected high costs in the future, dependency on custom products, missed opportunities to leverage commercial products and processes, and a continuing risk of product line instability and vulnerability.

In July 1999, the Under Secretary of Defense (Acquisition, Technology and Logistics) established a Display Overarching Integrated Process Team to recommend a defense-wide strategy to achieve assured and affordable access to flat panel display technology now and in the future. Team activities are focused on several objectives:

- Substantially rationalize flat panel display requirements across DoD platforms.
- Consolidate acquisitions.
- Establish a research and development strategy that promotes standardization and leverages commercial technology improvements.
- Effect long-term commitments to suppliers.
- Develop an implementation strategy for the above, by early spring, 2000.

6. Conclusions

The Department recognizes that America's national security, absolutely and indispensably, is tied to the health and well being of its industrial partners in the private sector. To support its defense strategy, DoD must access and efficiently utilize the best industrial resources available -- defense and commercial, domestic and international -- to obtain the lowest cost, highest performing products. In general, DoD believes that the industry supporting defense continues to be capable of generating the investment and skills necessary to provide affordable, innovative, and high quality defense products.

By and large, DoD has been able to preserve competition and innovation while allowing the defense industry to follow a rational course of consolidation. DoD will accrue over \$3.5 billion in certified consolidation savings through 2003. In the industrial base supporting defense, several capable firms in each major product area and a viable supply chain to support them, remain. Domestically, defense industry consolidation may have gone about as far as it can go at the prime contractor (weapon platform integrator) level and still preserve competition. At the second and third tiers, however, there still are opportunities for significant realignment and consolidation. In fact, realignment and consolidation activity there appears to be increasing.

In Europe, there also has been significant consolidation among the largest firms. As in the United States, there likely will be continued European industry restructuring as smaller defense and aerospace firms join or align themselves via supplier agreements with one of the larger industrial groupings. These developments suggest that U.S. - European mega-mergers in the defense field are not likely in the short term, although transactions involving subsystem and component suppliers may occur. DoD, however, will continue to foster closer industrial linkages (for example, encouraging cooperative programs, joint ventures, and international teaming arrangements; and modernizing and streamlining security policies associated with export control processes and the appropriate release of advanced technologies) with key coalition partners.

DoD understands its stewardship role with the industry and is confident that it can and will work with its suppliers to address industry concerns or problems as they arise. The Department is continuing to monitor developments within the industry that have the potential to impact industrial and technological capabilities and capacities, efficiency, and innovation. DoD is:

- Participating in merger and acquisition reviews to determine the transaction's effects on DoD programs, particularly regarding competition, innovation, and cost.
- Evaluating new approaches to address industrial issues within its technology and acquisition investment decision processes.
- Developing or improving defense-critical industrial and technological capabilities; and leveraging predominantly commercial and dual use capabilities and products for defense applications.

- Conducting assessments to identify and address potential industrial capabilities problems wherever they occur.

Section 2504 of Title 10 of the United States Code establishes Congressional policy designed to ensure the national industrial and technological base will continue to be able to meet the Nation's national security requirements. This report summarizes and documents the Department's commitment to ensure that policy is implemented efficiently and effectively.